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IMPORTANCE, CAUSES, AND MANAGEMENT RESPONSES TO FARM RISKS: EVIDENCE FROM FLORIDA AND ALABAMA

William G. Boggess, Kwabena A. Anaman, and Gregory D. Hanson

Abstract

Despite the contention that risk and uncertainty play an important role in agriculture in North Florida and South Alabama, very little is known about producers' perceptions of risk. This paper describes the procedures used and the results obtained from a statistically random survey of farmers' perceptions of the importance of various sources of risk and alternative risk management practices. Initially, farmers were asked to define risk and then to rank various sources of risk and management responses to risk based on the relative importance of each to their operation. Summary statistics, Chi-square analyses, and logistic regression techniques were used to analyze the data.

Key words: risk, uncertainty, management, logistic regression.

Farm risks faced by mixed crop and livestock farmers in North Florida and South Alabama depend to a large degree on the resource and climatic conditions of the area. The growing season is long, but the winters are too cold for citrus or winter vegetables. The summer months are warm and humid providing an excellent environment for insects, weeds, and diseases. Despite the fact that the area receives nearly 60 inches of rain yearly, drought is a frequent problem on the extremely sandy soils because of their low water holding capacity. Compounding these biological and climatic problems is the region's distance from and lack of ready access to major crop and livestock markets. The region can realistically be viewed as part of a 'fringe' agricultural area between the major

Corn Belt production to the North; wheat, cotton, and cattle operations to the West; and the high-valued citrus and vegetable production to the South. This area is part of an agricultural region that has been particularly characterized by grave financial difficulties in the 1980's (Farm Credit Administration).

While it is clear that risk and uncertainty play an important role in agriculture in the Southeast and in other regions, very little is known about producers' perceptions of risk issues. However, considerable risk research exists in the literature. Firm growth models now incorporate to varying degrees production, marketing, and financial risks (Hanson et al.; Richardson and Condra). Further evidence of treatment of risk is found in simulation analyses and specifically in areas such as irrigation (Boggess et al.; Mapp and Eidman), biophysical/bioeconomic analyses (Boggess and Amerling; Wilkerson et al.), integrated pest management (Carlson), and decision analyses in general (Anderson et al.). Risk has also become key in financial analyses (Barry, 1983a; Barry et al.; Eidman). Jolly provides a useful distinction between two broad risk management strategies: controlling risk exposure (e.g. insurance) and controlling risk impacts (e.g. use of insurance).

This level of activity in risk treatment and modeling begs the question, 'What have we learned about producers' risk attitudes?' The apparent response is that very little can be said with a high degree of confidence. On the positive side, it is safe to posit that risk averse behavior exists (Young et al.), edu-

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cation may increase willingness to bear risk (Eidman), attitudes toward risk change as new information becomes available and management objectives evolve (Young et al.), and measurement of risk preferences has been operationalized with the recent development of the interval approach (King and Robison).

However, several problems and disturbing issues exist with respect to treatment of risk. With notable exceptions, most risk analyses have utilized secondary data (Musser and Tew; Young et al.). Risk involved in livestock production has been much less studied than crop production (Musser and Tew). New questions have arisen regarding the intertemporal stability of farmer risk preferences (Love and Robison). The important requirements of data, model, and results validation are often neglected to a disturbing extent (McCarl and Nelson; Hanson and Eidman). Antle has recently suggested that risk averse behavior can be explained without recourse to Pratt absolute risk aversion coefficients and expected utility theory. Also in this regard, Weiss has recently provided examples establishing that *risk aversion cannot be universally equated to concavity of a utility function* (p. 11). It appears that risk averse behavior is explained by a multivariable function rather than one single attitude or attribute. While this has long been recognized in the literature, agricultural economists still frequently attempt to explain risk behavior with a single measure.

This study contributes toward the goal of establishing a more fundamental empirical basis for risk analyses. A strong empirical basis is necessary to qualitatively understand (and predict) how farmers (will) react to risk related aspects of production, marketing, finance, technology, and policy (Lee). In this regard, recognition of farmers' perceptions of the sources and importances of risk is necessary in order to characterize risk management responses in agriculture. The survey approach of this study is part of a larger effort (Patrick). Barry indicates that a few surveys have been conducted; however, the results have not been sufficiently comprehensive to understand how risk responses differ with firm and producer characteristics (May, 1983b).

Hypotheses to be tested in this study are: (1) sample producers perceive various sources of risk in a hierarchy of importance, (2) sample producers' perceptions of the relative importance of alternative sources of risk depend on socioeconomic characteristics of the producer (e.g. experience, education, size of farm, etc.), and (3) sample producers' risk management responses depend on socioeconomic characteristics of the producer (e.g. experience, education, size of farm, etc.). The remainder of the paper includes a description of the procedures used to survey producers' perceptions of various sources of risk and risk management strategies, a summary of the survey responses, and an analysis of the results.

SURVEY PROCEDURES

One of the primary objectives of the Southern Regional Research Project S-180, "An Economic Analysis of Risk Management Strategies for Agricultural Production Firms," is to assess farmers' perceptions of risk. In response to this objective, several project participants jointly developed a survey instrument (Patrick).¹ Part I of the questionnaire asked for general information about the farm (size, enterprises, form of business organization, etc.). In addition, the respondents were asked to define risk. Part II identified and briefly illustrated various sources of risk in crop and livestock production, respectively. Twenty sources of risk in crop production and 18 sources in livestock production were identified. Producers were asked to indicate the relative importance of each source using a scale from 1 (not important) to 5 (extremely important). Immediately after ranking each source of risk, the respondents were asked what, if any, management practices they used to combat that particular risk. Managerial responses to risk were listed and briefly described in Part III. Producers were asked to indicate the importance of each (on a scale of 1 to 5) and whether they used it. Part IV contained open-ended questions about producers' information needs for dealing with risk. The final section asked for socioeconomic information including age, education, experience,

¹ Copies of the risk survey questionnaire are available from the senior author upon request. The version used in this study was modified to some extent from the regional project version of the questionnaire in order to better probe certain production issues related to the area of study.

family size, race, net worth, off-farm employment, debt, and income.

In the Fall of 1983, 25 farmers in Jackson County, Florida and 23 farmers in Henry County, Alabama were selected with a statistically random sampling technique based on master lists of farmers in the respective counties.² The two counties are located within 25 miles of each other across the Florida and Alabama border. Agricultural crops and practices are similar in both counties. Personal interviews were conducted with each farmer. Summary statistics, Chi-square analyses, and logistic regression techniques were used to analyze the data.

RESULTS

Respondents' Definition of Risk

"Risk is a loaded gun," is how one rather forthright farmer defined risk. This definition captures the essence of the majority of responses. Nearly all of the farmers focused on the potential of negative outcomes and many expressed the probability notion in the definitions. A couple of farmers, however, included the potential for gain involved in any risky prospect.

Socioeconomic Characteristics of the Respondents

Forty-one of the farmers (20 from Florida and 21 from Alabama) produced both crops

TABLE 1. SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE RESPONDENTS IN NORTH FLORIDA AND SOUTH ALABAMA BY SIZE (ACREAGE) OF FARMS, 1983

Item	Size of farm			Total
	Small <150 acres	Medium 150-500 acres	Large >500 acres	
	Percent			
Financial leverage ratio:^a				
Zero	5.3(20.1) ^b	10.5(20.0)	2.6(12.4)	18.4
0.01-0.20	15.8(60.1)	18.4(35.0)	2.6(12.4)	36.8
0.21-0.50	2.6(9.9)	13.2(25.0)	7.9(37.6)	23.7
0.51-1.00	2.6(9.9)	10.5(20.0)	7.9(37.6)	21.1
Total	26.3(100.0)	52.6(100.0)	21.0(100.0)	100.0
Taxable farm income (\$):^c				
Negative	2.4(9.1)	9.5(19.0)	2.4(10.1)	14.3
0-9,999	14.3(54.6)	11.9(23.8)	2.4(10.1)	28.6
10,000-19,999	4.8(18.3)	11.9(23.8)	2.4(10.1)	19.1
20,000-49,999	4.8(18.3)	11.9(23.8)	7.1(29.8)	23.8
50,000-99,999	0.0(0.0)	2.4(4.8)	7.1(29.8)	9.5
100,000 or more	0.0(0.0)	2.4(4.8)	2.4(10.1)	4.8
Total	26.2(100.0)	50.0(100.0)	23.8(100.0)	100.0
Years of experience in farming:^d				
0-9	2.1(6.7)	6.3(13.2)	6.3(30.2)	14.6
10-24	16.7(53.4)	16.7(34.8)	2.1(10.1)	35.4
25-39	4.2(13.4)	10.4(21.6)	8.3(39.7)	22.9
40 years or more	8.3(26.5)	14.6(30.4)	4.2(20.1)	27.1
Total	31.3(100.0)	47.9(100.0)	20.8(100.0)	100.0
Education^d				
Some high school	10.4(33.2)	16.7(34.9)	2.1(10.1)	29.2
High school graduate	4.2(13.4)	10.4(21.7)	8.3(39.9)	22.9
Two year college/vocational	10.4(33.2)	12.5(26.1)	2.1(10.1)	25.0
Four year college	6.3(20.1)	8.3(17.3)	8.3(39.9)	22.9
Total	31.3(100.0)	47.9(100.0)	20.8(100.0)	100.0
Dominant crop grown^d				
Peanuts	18.8(60.1)	37.5(78.3)	10.4(50.0)	66.7
Any other crop	12.5(39.9)	10.4(21.7)	10.4(50.0)	33.3
Total	31.3(100.0)	47.9(100.0)	20.8(100.0)	100.0

^aValues are based on 38 responses. Financial leverage is defined as total debts divided by total assets.

^bValues in parenthesis are the percent within each size strata.

^cValues are based on 42 responses.

^dValues are based on 48 responses.

² Master lists of farmers in each county were obtained from the local Agricultural Stabilization and Conservation Service (ASCS) offices. Random number generators were used to randomly select sample farmers from the list. This technique has the advantage that the probability that a particular "category" of farmers will be sampled is equal to the population frequency. Conversely, the disadvantage is that relatively few observations are obtained for certain categories.

and livestock, five farmers (three from Florida and two from Alabama) produced only crops while two farmers (both from Florida) produced only livestock. Forty of the sample farmers were white and the remaining eight were black. Forty-six of the 48 farmers were married and the average number of dependents was 2.3. The average size of farms with crop and harvested forage production was 312 acres, while the average acreage of pasture and range was 172 acres. Tables 1 and 2 present a breakdown by size of farm and financial leverage ratio for various socioeconomic characteristics of the respondents.

Leverage, defined as total farm debts divided by total farm assets, is a commonly used measure of financial solvency. A leverage ratio of 0.50 or greater is normally regarded as unstable and a ratio of 1.0 indicates that the farm is bankrupt. Eight of the farmers had leverage ratios greater than 0.50 (ranging from 0.52 to 0.84), while seven farmers had zero leverage ratios.

Larger farms tended to be more highly leveraged. Three-fourths of the large farms had leverage ratios over 0.20 as compared to 45 percent for medium and only 20 percent for small farms, Table 1. Thirty percent of all large farms were managed by farmers with less than 10 years of farming experience as compared to 13 and 7 percent for medium and small farms, respectively, Table 2. Similarly, 62 percent of the farmers with 40 years or more experience had leverage ratios

of 0.20 or lower and none had a ratio greater than 0.50. One explanation for this phenomenon might be life cycle differences among farmers. That is, the more experienced farmers have already paid for the majority of their fixed assets and, thus, are no longer interested in expanding their operations as retirement nears.

Based on 1982 taxable farm income, 14.3 percent of the sample farmers had negative incomes, Table 1. Six (14.3 percent) of the farmers had incomes of \$50,000 or more while 62 percent of the farmers had income of less than \$20,000. Only 18 percent of the small farms reported taxable incomes of \$20,000 or more; whereas, 33 percent of the medium farms and 70 percent of the large farms reported taxable incomes over \$20,000.

The average farming experience was 26.5 years with a standard deviation of 14.1. Seventy percent of the farmers had completed high school. Twenty-five of the farmers had either attended two-year college or vocational school. Two-thirds of the respondents listed peanuts as their dominant crop.

Sources of Risk

Over half of farmers' definitions of risk explicitly mentioned weather or pests. Not surprisingly then, production risks, specifically rainfall variability and pests (insects, weeds, and diseases), were identified as the

TABLE 2. SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE RESPONDENTS IN NORTH FLORIDA AND SOUTH ALABAMA BY THE FINANCIAL RATIO OF FARMS, 1983

Item	Financial leverage ratio ^a			Total
	Low (0.00-0.20)	Medium (0.21-0.50)	High (0.51-1.00)	
	percent ^b			
1982 taxable farm income (\$):				
Negative	5.4(9.5) ^b	5.4(25.0)	2.7(12.5)	13.5
0-9,999	24.3(42.8)	2.7(12.5)	5.4(25.0)	32.4
10,000-19,999	10.8(19.0)	2.7(12.5)	2.7(12.5)	16.2
20,000-49,999	10.8(19.0)	2.7(12.5)	10.8(50.0)	24.3
50,000-99,999	5.4(9.5)	2.7(12.5)	0.0(0.0)	8.1
100,000 or more	0.0(0.0)	5.4(25.0)	0.0(0.0)	5.4
Total	56.8(100.0)	21.6(100.0)	21.6(100.0)	100.0
Years of experience in farming:				
0-9	7.9(14.3)	2.6(11.0)	2.6(12.3)	13.2
10-24	26.3(47.6)	5.3(22.4)	10.5(49.8)	42.1
25-39	7.9(14.3)	7.9(33.3)	7.9(37.9)	23.1
40 years or more	13.2(23.9)	7.9(33.3)	0.0(0.0)	21.1
Total	55.3(100.0)	23.7(100.0)	21.1(100.0)	100.0
Dominant crop grown:				
Peanuts	36.8(66.5)	15.8(66.7)	13.2(62.6)	65.8
Any other crop	18.4(33.4)	7.8(33.2)	7.9(37.4)	34.2
Total	55.3(100.0)	23.7(100.0)	21.1(100.0)	100.0

^aValues are based on 38 responses. Leverage ratio is defined as total debt divided by total assets.

^bValues in parentheses are the percent within each leverage strata.

major sources of crop risk, Table 3. With respect to rainfall variability, irrigation was the most common management response volunteered by the respondents.³ Other common management practices used to combat rainfall variability included: minimum tillage, subsoiling, and crop selection (wheat and grain sorghum).

Chemical control dominated management responses to pests. Chemicals were used to control weeds, insects, diseases, and nematodes. Each of these pests are major problems due to the warm, humid climate. Rotating grass crops between crops of soybeans or peanuts to control nematodes was the second most common practice. Other common management responses to production risks included: using resistant varieties, scouting for insects and diseases, planting corn early before heavy insect infestation, and routinely spraying and worming livestock.

Market related risks were the second most important category of risk with variability in commodity prices leading in importance. Variability in the costs of operating inputs and in the cost of equipment was also considered important sources of risk, Table 3. Forward contracting was the most common management response to variability in commodity prices. Soybeans were the most common commodity contracted. Other less-

common management responses to market risks were drying and storage and "shopping" for the best price. Farmers, for the most part, believed that there was little they could do to combat variability in the costs of operating inputs or equipment. Most indicated that they "shopped around" and attempted to take advantage of cash or quantity discounts on operating inputs. However, with the average farm size being 312 acres, bulk discounts were uncommon. In the case of capital equipment, most farmers indicated that they delayed replacing equipment and concentrated on maintenance of existing machinery.

Since peanuts were the dominant cash crop in the area for farmers with an allotment, it is not surprising that government commodity programs were the fifth highest ranked source of risk. Farmers frequently mentioned uncertainty over the future of the peanut program as a major risk factor. The future of Payment-In-Kind (PIK) or similar programs was another common concern.

Table 4 reports the results of the importance of the sources of risk in livestock production. Commodity prices ranked first followed by weather variability and diseases and pests in exact reverse to the rankings of crop risks. In addition, the mean ranking of each source of risk in livestock is slightly

TABLE 3. MEAN IMPORTANCE RANKINGS AND STANDARD DEVIATIONS OF SOURCES OF RISK AND VARIABILITY IN CROP PRODUCTION BY SAMPLE FARMERS IN NORTH FLORIDA AND SOUTH ALABAMA, 1983

Item no.	Source of risk and variability	Mean ranking of importance	Ranking class	Standard deviation
1	....Rainfall variability	4.70	..... Extremely important	0.59
2	....Diseases and pests	4.50		0.75
3	....Commodity prices	4.22		1.01
4	....Inflation	3.60	..... Very important	1.64
5	....Government commodity programs	3.53		1.39
6	....Costs of operating inputs	3.50		1.17
7	....Personal safety and health	3.35		1.42
8	....World economic situation	3.16		1.36
9	....Cost of capital equipment	3.15		1.41
10	....Cost of credit	3.04		1.72
11	....Federal and state government laws	2.96	..... Moderately important	1.69
12	....Family plans	2.51		1.59
13	....Theft of farm equipment, etc.	2.33		1.59
14	....Hired labor	2.24		1.79
15	....Changes in technology	2.22		1.59
16	....Availability of loan funds	2.06		1.55
17	....Use of leverage	2.00		1.55
18	....Other climatic factors (wind, etc.)	2.00		1.83
19	....Leasing	1.67	..... Not important	1.83
20	....Freezes	0.91		1.09

³ Immediately after ranking the importance of each source of risk, the respondents were asked what management responses they used to combat that particular source of risk. These responses provided the basis for the volunteered management responses. Later in the survey, the respondents were asked to rank the importance of a series of suggested management responses. The results from this latter ranking are presented in the next section.

TABLE 4. MEAN IMPORTANCE RANKINGS AND STANDARD DEVIATIONS OF SOURCES OF RISK AND VARIABILITY IN LIVESTOCK PRODUCTION BY SAMPLE FARMERS IN NORTH FLORIDA AND SOUTH ALABAMA, 1983

Item no.	Source of risk and variability	Mean ranking of importance	Ranking class	Standard deviation
..... Very important				
1	....Livestock and product prices	3.74		1.13
2	....Weather variability	3.59		1.50
3	....Diseases and pests	3.22		1.39
4	....Costs of operating inputs	3.19		1.33
..... Moderately important				
5	....Personal safety and health	2.82		1.47
6	....Inflation	2.70		1.68
7	....World economic situation	2.55		1.55
8	....Cost of capital equipment	2.55		1.58
9	....Theft of equipment, etc.	2.17		1.58
10	....Federal and state laws	2.10		1.48
..... Not important				
11	....Family plans	1.97		1.56
12	....Changes in technology	1.87		1.52
13	....Cost of credit	1.85		1.96
14	....Use of leverage	1.67		1.44
15	....Hired labor	1.62		1.78
16	....Availability of loan funds	1.61		1.51
17	....Government agricultural programs	1.57		1.74
18	....Leasing	0.85		1.37

lower than the ranking of that source of risk in crop production.

Management Responses to Risk

In addition to ranking the importance of various sources of risks and indicating how producers attempted to manage those risks, farmers were asked to rank the importance

of and indicate whether or not they used a series of suggested management responses, Table 5. Not surprisingly, there was considerable overlap between their volunteered management responses and their subsequent ranking of the suggested management responses. Management practices designed to combat production risks that were given high ranks included diversification and maintaining feed reserves.

TABLE 5. MEAN IMPORTANCE RANKINGS AND STANDARD DEVIATIONS OF MANAGEMENT RESPONSES TOWARDS RISK AND VARIABILITY IN BOTH CROP AND LIVESTOCK PRODUCTION BY SAMPLE FARMERS IN NORTH FLORIDA AND SOUTH ALABAMA, 1983

Item no.	Management response	Mean ranking of importance	Standard deviation	Ranking class	Percentage of farmers using response
..... Very important					
1	.... Enterprise diversification	3.87	1.52		83.0
2	.... Pacing of investment and expansion	3.77	1.42		87.5
3	.... Market information	3.69	1.45		89.4
4	.... Government commodity programs	3.58	1.53		87.2
5	.... Maintaining financial reserves	3.58	1.53		74.5
6	.... Production practice—diversification	3.47	1.44		87.2
7	.... Maintaining feed reserves	3.46	1.67		74.5
8	.... Spreading sales	3.40	1.70		74.5
9	.... All-risk crop insurance	3.02	1.92		67.4
..... Moderately important					
10	.... Maintaining flexibility in farm organization	2.90	1.48		70.8
11	.... Forward contracting	2.87	1.85		74.5
12	.... Off-farm activities by other family members	2.60	1.95		54.2
13	.... Idling production capacity	2.56	1.37		48.3
14	.... Debt management	2.48	1.99		47.9
15	.... Holding inventory reserves	2.42	1.75		56.5
16	.... Off-farm activities by farm operator	2.17	2.13		41.7
..... Not important					
17	.... Holding credit reserve	1.96	1.82		45.8
18	.... Utilizing government credit program	1.94	1.89		43.8
19	.... Geographical diversification	1.50	1.69		19.2
20	.... Use of future markets	0.87	1.25		8.5
21	.... Hail insurance	0.58	0.77		6.5

A second group of management responses dealt with managing price risks. Using market information and spreading sales were the highest ranked practices in this category. Surprisingly, forward contracting was not rated as particularly important even though a majority of farmers indicated use of forward contracts. The farmers unanimously agreed that hedging in the futures market was not an important risk management practice giving it the second lowest rating after hail insurance. Only 8 percent of the sample farmers had ever used the futures market. The low rating of hedging is probably a function of lack of familiarity with hedging, relatively small quantities of grain production, and the distance and lack of access to the major grain markets with the associated variability in the basis.

Highly ranked financial risk management practices included pacing of investments and expansion and maintenance of financial reserves. Participation in government commodity programs which affects (limits) both production and price risks was also highly ranked.

Socioeconomic Characteristics of Farmers and the Importance Attached to Sources of Risk

It was hypothesized that farmers' attitudes and perceptions toward risk and variability may be related to certain socioeconomic variables. To investigate possible relationships, Chi-square tests were performed with six socioeconomic variables versus the degree of importance attached to each of the 20 risk sources in crop production and 18 sources of risk in livestock production.

To eliminate statistical problems associated with low frequencies in cells of the Chi-square test, the numerical rankings of the degree of importance attached to each risk source, which ranged from 0 to 5, were reduced to two categories: either *not* important (0,1,2) or important (3,4,5). The six socioeconomic variables tested were experience in farming, state of residence, educational level of farmer, dominant crop grown, size of farm, and leverage ratio of the farm.

Of the 38 alternative sources of risk in crop and livestock production, 22 have no significant relationship with any of the six socioeconomic variables. The size of farm is related significantly to six sources of risk, Table 6. It is positively related to diseases

and pests, costs of operating inputs, theft of farm equipment, inflation, and government agricultural programs. Experience in farming is negatively related to risk of changes in family plans in crop production and of availability of loan funds and cost of credit in livestock production. These results are consistent with the widely held hypothesis that experience helps the farmer to adapt to the risks of farming.

With regard to the state of residence of the farmer, only leasing in crop production had a significant relationship. Florida farmers perceive leasing in crop production as less important than Alabama farmers. Leasing was also the only source of risk significantly related to the dominant crop grown. Peanut farmers perceived leasing of crop land as a more important problem than other farmers.

Three sources of risk (other climatic factors, leasing in crop production, and changes in family plans of livestock producers) were positively related, at a 10 percent level of significance, with educational level. Producers' leverage ratio was inversely related with changes in crop technology and with federal and state regulations in livestock production, but directly related to the risks of using leverage.

Socioeconomic Characteristics and the Use of Management Responses Towards Risk

It is hypothesized that farmers' responses toward risk and variability are related to or are influenced by their socioeconomic characteristics. A logistic regression is used to investigate whether the use of the risk management responses by farmers in the survey area is related to the following socioeconomic variables—experience in farming, state of residence, dominant or major crop grown, size of the farm, leverage ratio of the farm, educational level of the farmer, and the ethnic group of the farmer.

The logit model employed is of the form:

$$(1) \ln \frac{P_i}{1-P_i} = a_0x_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6 + a_7x_7 + e_i,$$

where P_i is the probability that the farmer will use a certain risk management response i and $P_i/(1-P_i)$ is the likelihood favoring the use of the particular risk management response; x_j is the j th socioeconomic variable;

TABLE 6. SOURCES OF RISKS AND VARIABILITY IN CROP AND LIVESTOCK PRODUCTION THAT ARE SIGNIFICANTLY RELATED TO SOCIOECONOMIC CHARACTERISTICS OF FARMERS IN NORTH FLORIDA AND SOUTH ALABAMA, 1983

Socioeconomic variable	Level of statistical significance		
	10 percent	5 percent	1 percent
Experience in farming:	(a) Changes in family plans in crop production(-) ^a	(a) Use of leverage in livestock production(+) (b) Availability of loan funds in livestock production(-) (c) Cost of credit in livestock production(-)	
State of residence:			(a) Leasing in crop production(-)
Educational level:	(a) Other climatic factors such as wind in crop production(+) (b) Leasing in crop production(+) (c) Changes in family plans in livestock production(+)		
Dominant crop grown: 1 peanuts 2 other crops		(a) leasing in production(-)	
Size of farm:	(a) Diseases and pests in livestock production(+) (b) Costs of operating inputs in livestock production(+) (c) Government agricultural programs(+) (d) Theft of equip. and produce in livestock production(+)	(a) Inflation in livestock production(+) (b) Freezes in crop production(-)	
Leverage ratio:	(a) Changes in technology in crop production(-) (b) Federal and state laws regulations in livestock production(-)	(a) Use of leverage(+)	

^aSigns in parenthesis indicate the nature of the relationship; (+) indicates a direct relationship and (-) indicates an inverse relationship.

a_j is the parameter estimate where $j = 1 \dots 7$. \ln is the natural logarithm and e_i is the error term in the equation which is assumed to be normally distributed with a zero mean and a constant variance. Solving the model equation for P_i , it can be shown that:

$$(2) P_i = \frac{e^{\sum a_j x_j}}{1 + e^{\sum a_j x_j}} \text{ or } P_i = \frac{1}{1 + e^{-\sum a_j x_j}}$$

Theil (pp. 632-33) and Johnston (pp. 426-28) indicate that logistic regression equations can be estimated by weighted least squares or maximum likelihood procedures. In this particular application, the dependent variable is a binary choice variable (i.e., use of the practice is denoted by 1 and non-use by 0); thus, the generalized least-squares method is unworkable. Therefore, the logit

equation was estimated using the maximum likelihood procedure of the FUNCAT program described in SAS Institute, Inc. In the beginning, all seven explanatory or socioeconomic variables were used. However, race and educational level did not offer significant explanatory power and, thus, they were dropped from the model.

After the program was run with this reduction in explanatory variables, six of the 21 risk management responses showed a significant relationships with at least one of the socioeconomic variables, Table 7. The seven risk management responses were: (a) maintaining financial reserves, (b) holding credit reserves, (c) debt management, (d) utilizing government credit program, (e) off-farm employment by the farm operator, and (f) off-

TABLE 7. RESULTS OF THE LOGIT REGRESSION OF THE RISK MANAGEMENT RESPONSES VERSUS THE SOCIOECONOMIC CHARACTERISTICS OF FARMERS IN NORTH FLORIDA AND SOUTH ALABAMA, 1983^a

Equation no.	Risk-management response ^c	Parameter estimates of explanatory variables ^b					
		Intercept	Experience	State	Crop	Leverage	Size
1	Maintaining financial reserves	2.5623 (0.1132)	-0.0805 (0.0778)	-0.9821 (0.1440)	1.7263 (0.0219)	-6.9092 (0.0199)	0.0083 (0.0322)
2	Holding credit reserves	-0.0724 (0.4996)	-0.0066 (0.8159)	0.7837 (0.0920)	-0.3234 (0.4959)	3.5429 (0.0435)	8.311 × 10 ⁻⁶ (0.9957)
3	Debt management	-0.8149 (0.5121)	0.0058 (0.8603)	-0.4839 (0.3453)	0.2380 (0.6388)	7.8821 (0.0089)	-0.0040 (0.1237)
4	Utilizing government credit programs	-3.5228 (0.0156)	0.0846 (0.0267)	-1.1796 (0.0421)	1.0217 (0.0685)	4.4444 (0.0346)	-0.0014 (0.5420)
5	Off-farm activities by farm operator	2.9632 (0.0481)	-0.0162 (0.6542)	-0.3882 (0.5147)	0.2763 (0.6837)	3.7123 (0.1132)	-0.0142 (0.0090)
6	Off-farm activities by other family members	2.7862 (0.0400)	-0.0402 (0.2228)	0.0546 (0.9043)	-0.3340 (0.4878)	3.2993 (0.1059)	-0.0057 (0.0138)

^a The level of statistical significance for each parameter estimate is in parenthesis.

^b The explanatory variables are denoted as follows: experience—experience in farming in years; state—the state of residence of the farmer, 0 denotes Alabama and 1 denotes Florida; crop—dominant or major crop grown by the farmer, 0 denotes peanuts and 1 denotes any other crop; leverage—the leverage ratio of the farm; and size—the size of the farm under crops or harvestable forage in acres.

^c The dependent variable reflects use versus non-use of the risk management response. Use of a management response is denoted by 1 and non-use by 0. The actual dependent variable estimated in $\ln(P_i / 1 - P_i)$.

farm activities by family members, other than the operator. Using 10 percent as the maximum acceptable level of significance, the socioeconomic variables that were significantly related to the use of the risk management responses are as follows, Table 7.

Equation 1: Maintaining Financial Reserves

Maintaining financial reserves becomes increasingly used with increasing size of the farm and the growing of a dominant crop other than peanuts. Use of this response, however, decreases with more farming experience and increased leverage. The small positive coefficient for size of farm suggests that larger farms use more funds and are slightly more apt to hold financial reserves to deal with shocks or unexpected changes in the environment. This result appears inconsistent with the finding that larger farms tend to be more highly leveraged, Table 1. Given the magnitude of the coefficient, the first result perhaps should be downplayed. Alternatively, it may be that larger farms tend to both use leverage and keep financial reserves.

Peanuts are a restricted crop under the government's commodity programs. Farmers cultivating this crop as their dominant crop have more reliable and stable income and appear less likely to maintain financial reserves than those farmers growing other crops

as their dominant crop. Experience in farming leads to declining use of financial reserves as the increased skills of the farmers allow them to adapt to the risky and uncertain environment. Increasing leverage of the farm decreases the use of this management response because financial reserves will normally be used before extensive debt levels are incurred.

Equation 2: Holding Credit Reserves

Holding credit reserves was used increasingly with increasing leverage. This result may indicate that farmers misunderstood what was meant by a credit reserve or it may suggest that farmers who tend to use credit appreciate the importance of a credit reserve. Florida farmers appeared to use this management response more on average than Alabama farmers.

Equation 3: Debt Management

The use of debt management as a risk management tool increased with increasing leverage. This statement implies that the increasing debt-to-assets ratio requires the management of debts to maintain stable and healthy growth and to avoid farm bankruptcy.

Equation 4: Utilizing Government Credit Programs

Utilizing government credit programs such as the Farmers Home Administration loans increased with increasing leverage of the farm,

experience in farming,⁴ and the cultivation of non-peanut crops as the dominant crop by the farmer. Higher leverage was directly related to greater use of government disaster loans and Farmers Home Administration loans. The cultivation of crops other than peanuts as the dominant crop means that the farmer is less likely to achieve the more stable and reliable income obtained from peanuts. Finally, Florida farmers appeared less likely to utilize government credit programs than Alabama farmers.

Equation 5: Off-Farm Activities by the Farm Operator

The use of this risk management response was negatively related to the size of the farm. Larger farms require the full attention of the operator and hence there is less time for the operator to devote to off-farm activities. While off-farm employment does have a portfolio effect, the limited resource base of small farms and the corresponding diminishing returns to labor is probably the principal cause of the above relationship.

Equation 6: Off-Farm Activities by Other Members of the Family

The use of this management response was also inversely related to the size of the farm. The explanation may be that larger farms may require the labor services of the other members of the family, thus depriving them of time to perform off-farm jobs.

Use of off-farm activities by other members of the family appeared to increase with increasing leverage of the farm, Table 7. This finding is intuitively appealing since higher leverage farmers tend to require funds generated by off-farm activities in order to meet cash flow requirements. This relationship may be a function of particular financial plans rather than specifically relating to risk.

SUMMARY

The survey results shed useful light on farmers' perceptions of risk, risk sources, and risk management practices in North Florida and South Alabama. The respondents tended to define risk in terms of the potential or probability of negative outcomes.

Despite a relatively diverse sample in terms of education, experience, farm size, leverage ratio, and farm income, there was considerable agreement on the relative importance of various sources of risk and alternative risk management practices. Less than half of the rankings of sources of risk and only a third of the responses on the use of management practices had significant relationships with any of the six socioeconomic variables. Production risks (rainfall variability and diseases and pests) were identified as the most important category of crop risks, followed by market risks (variability in commodity prices, inflation, and variability in costs of operating inputs) and financial risks (cost of credit, availability of loan funds, and use of leverage).

In general, livestock risks were ranked as less important than crop risks. However, four risk sources (livestock products, weather variability, diseases and pests, and cost of operating inputs) were considered very important.

Logistic regression techniques were used to investigate the effect of various socioeconomic characteristics of the respondents on the probability that they use a particular risk management practice. The firm's leverage ratio and size and the producer's experience were the three most important variables in determining use versus non-use of the risk management practices. Producers with high leverage ratios were much less likely to hold financial reserves, but more likely to have used government credit programs, debt restructuring, credit reserves, and off-farm employment. Larger farmers were more apt to maintain financial reserves, but less apt to use off-farm employment. More experienced farmers were more likely to maintain financial reserves and more apt to have used government credit programs sometime during their career.

The analysis seemed to identify two groups of producers. One group consisted of farmers who are relatively older, more experienced, and better established. These farmers tended to have smaller acreages and very little leverage and, though not highly profitable, they were financially secure. The second group consisted of younger, more aggressive farmers. These farmers tended to have larger

⁴ This result appears inconsistent with normal expectations, since more experienced farmers are expected to rely less on government subsidized credit. However, the responses to this question were based on whether they had ever used government credit programs during their career, not whether they were currently using the programs.

acreages and high leverage ratios resulting in tenuous financial positions.

Several implications can be drawn from the study. Respondents were clearly able to rank the relative importance of various sources of management responses to risk. This information provides a strong empirical basis for targeting research and extension programs in the area. For example, if it is carefully demonstrated that rainfall variability and commodity price variability are priority risk sources of concern to farmers, it becomes more justifiable to commit scarce resources to studying these problems. In addition, it would be interesting to compare the rankings obtained in this area with similar results in other regions.

There was a surprising degree of consensus on the relative rankings, despite a relatively

diverse sample across socioeconomic groups. In many cases, the null hypothesis that the relative importance or use of a management response across socioeconomic groups was the same was maintained. However, there were some important exceptions, in particular the use of financial risk management practices (e.g. government credit programs, credit reserves, debt restructuring, off-farm income, and maintaining financial reserves) which were shown to vary significantly with the firm's leverage ratio and size and with the producer's experience. Use of this information should allow more precision in the design of research, extension, and lending practices relating to financial risk management, while at the same time suggesting that detailed breakdown by socioeconomic groups are unnecessary for production and market risk research and extension.

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