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Measuring Farmers' Risk Attitudes: A Case Study of the Eastern High Plateau Region of Algeria

Abderrezak Belaid and Stanley F. Miller

A modified experimental approach is used to elicit farmer utility functions in the eastern high plateau of Algeria. Based on the results, the hypothesis is tested that farmers' risk attitudes are modified by the agroecological zone in which they live, by the crops they grow, and the type of sector (private or socialist) in which they produce. It is concluded that, while the studied farmers are risk averse, no intrinsic difference exists in farmers' attitudes between sectors or sites.

Key words: Algeria, risk and uncertainty, socialist decision making.

In this study, farmers' risk attitudes in the eastern high plateau region of Algeria are reported. The high plateau, cereal-producing region of Algeria, is characterized by relatively low and erratic precipitation concentrated in the winter season. The area experiences a high frequency of late frost and early sirocco (dry desert wind). These characteristics result in unstable farm incomes. Farmers whose survival hinges on their production may be more sensitive to income variability than to average income and often exhibit high aversion to risk. Successful policies aimed at improving agricultural production, therefore, must include consideration of farmers' attitudes toward risk.

Farmers' risk attitudes may be influenced by the agroecological zone in which they live, by the crops they grow, and by the sector in which they work. This situation-specific hypothesis regarding risk attitudes is tested in this study. Risk attitudes are estimated for farmers (private and socialist) producing wheat and/or barley in the three agroclimatic zones representative of the Algerian high plateau.¹

Farmers' risk preferences often are elicited through farmer interviews structured to identify their utility functions for income or wealth $U(X)$. During the interview, a series of questions based on the continuity axiom are asked. However, two problems have been noted which raise questions about the reliability of the estimates. The first arises if the subjects capriciously choose among alternative prospects. The hypothetical nature of most interview questions may not encourage truthful answers. A second problem arises from the farmer's need to use abstract probabilities to choose among the alternatives.

To overcome these problems, an experimental approach originally developed by Binswanger in India (Binswanger 1981) was modified and employed in this study. The modified approach requires farmer selection between real, nontrivial alternative payoffs, where adequate time is given to the interviewee to un-

assembly of permanent workers meets periodically to vote on production and financial policies (within a framework defined by the Ministry of Agriculture). A workers' council and a management committee with an elected president oversee and implement the assembly's decisions. A director is appointed by the Ministry of Agriculture to provide technical assistance to the farm and to act as a liaison between the government and the farm. This sector covers about 30% of the country's cultivable area. (b) An agrarian revolution sector organized into cooperatives and covering about 10% of the country's cultivable area. (c) A private sector occupying the remainder of the cultivable area. More than half of the holdings of this sector are less than 5 hectares in size. Only sector (a) (socialist) and sector (b) (private) are considered in this study.

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¹ There are three distinct agricultural sectors in Algeria. (a) A socialist sector consisting of large, highly mechanized farms. An

Table 1. Schedules of Alternatives

Scale	Alternatives	Real Games		Expected Value	Standard Deviation
		Tail	Head		
..... (DA)					
5 DA ^a	A	0	0	0	0
	B	-.50	4.50	2	2
	C	-1.00	7.00	3	4
	E	-2.00	10.00	4	6
	F	-3.00	11.00	4	7
	G	-4.00	14.00	5	9
	H	-5.00	15.00	5	10
	50 DA	A	0	0	0
B		-5.00	45.00	20	25
C		-10.00	70.00	30	40
E		-20.00	100.00	40	60
F		-30.00	110.00	40	70
G		-40.00	140.00	50	90
H		-50.00	150.00	50	100
200 DA		A	0	0	0
	B	-20.00	180.00	80	100
	C	-40.00	280.00	120	160
	E	-80.00	400.00	160	240
	F	-120.00	440.00	160	280
	G	-160.00	560.00	200	360
	H	-200.00	600.00	200	400
	Hypothetical Games				
1,000.00	A	0	0	0	0
	B	-100.00	900.00	400	500
	C	-200.00	1,400.00	600	800
	E	-400.00	2,000.00	800	1,200
	F	-600.00	2,200.00	800	1,400
	G	-800.00	2,800.00	1,000	1,800
	H	-100.00	3,000.00	1,000	2,000
	5,000.00	A	0	0	0
B		-500.00	4,500.00	2,000	2,500
C		-1,000.00	7,000.00	3,000	4,000
E		-2,000.00	10,000.00	4,000	6,000
F		-3,000.00	11,000.00	4,000	7,000
G		-4,000.00	14,000.00	5,000	9,000
H		-5,000.00	15,000.00	5,000	1,000

^a At the time of the experiment, US \$1.00 was approximately equal to 4.75 DA.

derstand the use and implications of probabilities.²

The Experiment

The experimental approach used consisted of offering the subject a choice among seven alternatives; the outcome was determined after a flip of a coin. Based on the outcome, money was collected or distributed. The schedules of alternatives are shown in table 1. Each subject

selected one alternative from the seven listed on each schedule. Each alternative consists of two amounts of money—a gain (head) and a loss (tail).³ Every game contains a safe alternative (alternative A). The selection of alternative A is equivalent to not playing the game. Expected gain increases from alternative A to H as does the standard deviation.

Prior to playing the games, each subject in the private sector was given a predetermined amount of money. No use constraint was placed on the money; thus it was a true windfall. The

² For a detailed explanation of the experimental approach, see Belaid, Binswanger (1977), and Sillers.

³ Unlike Binswanger, this experiment used alternatives including gains as well as losses.

Table 2. Risk Classification at 200-DA Level

Choice	Payoff in DA		Risk Class ^a	S Measure
	Tail	Head		
A	0	0	Extreme	Infinity to 7.5
B	-20.00	180.00	Severe	7.5 to 1.784
C	-40.00	280.00	Intermediate	1.74 to .81
E	-80.00	400.00	Moderate	.81 to .316
F	-120.00	440.00	Inefficient	
G	-160.00	560.00	Slight to neutral	.316 to 0
H	-200.00	600.00	Neutral to negative	0 to -infinity

^a As proposed by Binswanger (1977).

only requirement was that when the subject participated in the game, he had to have the amount required to pay the loss, if needed. Thus, the subject perceived that possible loss as real.⁴ The money, dinar (DA), was distributed as follows: (a) 20 DA eight days before the first of the four 5-DA rounds; (b) 100 DA eight days before the first of the two 50-DA rounds; (c) 200 DA five days before the single 200-DA round.

The newness of the experiment to the farmers necessitated extra care in explaining the process. It was vital to the experiment that participants clearly understood that the money given to them was theirs to keep. The seven alternatives were carefully explained (photographs of alternatives were distributed when the money was handed out). Two hypothetical rounds at the 5-DA scale were played to familiarize the subjects with the games and to determine and correct any potential problems before starting the experiment.

In order to play the games with "socialist farmers," the process was slightly modified. Decision making in the socialist sector is shared. In theory, three levels exist in the socialist decision hierarchy: workers, management, and government (Ministry of Agriculture). In practice, the socialist sector decision-making process rests with two persons, the president of the workers' assembly, who is the worker's legal representative, and the director of the farm, who is the government's representative. In the experiment, these two individuals jointly selected among the experiment alternatives. When they did not agree, they had to compromise. In addition, the four 5-DA rounds were eliminated and were replaced by

two 10-DA rounds because the payoffs were thought to be too low to be shared by two persons.

A common criticism of the experimental approach relates to the size of the payoffs involved (Young). Enough money must be given so that the subject has a high degree of interest in the outcome. In this experiment, the highest payoff of the 5-DA game was 20 DA. This is a nontrivial payoff, equivalent to one-fourth of an average daily wage. The highest payoff of the 200-DA scale was 800 DA, which is equivalent to ten daily wages. Additionally, several hypothetical payoffs were included which were much higher (up to 20,000 DA, which represents about 125% of a tractor driver's annual salary). Available funds precluded real payoffs for the hypothetical games; however, it is believed that the interest stimulated in the earlier games carried over to the hypothetical games.

The Region

Three communes (El-Eulma, Oum Ladjoul, and Beni Fouda) with different agronomic and economic characteristics in the high plateau cereal-producing region of Algeria were surveyed to construct a sampling frame. Generally, economic returns from farming decrease going from north to south on the plateau. Beni Fouda represents the northern zone. It has more favorable growing conditions and produces a large percentage of durum and bread wheat, which have higher government-controlled prices. Thus, Beni Fouda farmers have a double advantage compared to farmers in other zones of the plateau—a better environment and a higher price for the most suitable cereal crops.

The central zone, represented by El-Eulma, has an equal distribution between wheat and

⁴ Originally, a "gains only" sequence was used. However, it became obvious that subjects were not at ease with that game format. When the author proposed the "gains and losses" format, it was unanimously preferred.

Table 3. Percentage Distribution of Farmers' Risk Preferences by Site

Game Scale	Risk Class	E. Eulma	O. Ladjoul	B. Fouda	S. Sector
5 DA	Extreme to Severe (A & B)	13.64	15.38	25.00	10.00
5 DA	Intermediate to Moderate (C & E)	54.55	65.38	65.00	70.00
5 DA	Slight to Negative (G & H)	31.82	15.38	5.00	10.00
5 DA	Inefficient (F)	.00	3.85	5.00	10.00
50 DA	Extreme to Severe (A & B)	13.64	15.38	35.00	10.00
50 DA	Intermediate to Moderate (C & E)	68.18	76.92	60.00	85.00
50 DA	Slight to Negative (G & H)	18.18	7.69	5.00	5.00
50 DA	Inefficient (F)	.00	.00	.00	.00
200 DA	Extreme to Severe (A & B)	18.18	23.08	35.00	20.00
200 DA	Intermediate to Moderate (C & E)	63.64	69.23	60.00	80.00
200 DA	Slight to Negative (G & H)	13.64	3.85	.00	.00
200 DA	Inefficient (F)	4.55	3.85	5.00	.00
1,000 DA	Extreme to Severe (A & B)	27.27	26.92	45.00	30.00
1,000 DA	Intermediate to Moderate (C & E)	63.64	61.54	50.00	70.00
1,000 DA	Slight to Negative (G & H)	9.09	11.54	.00	.00
1,000 DA	Inefficient (F)	9.09	.00	5.00	.00
5,000 DA	Extreme to Severe (A & B)	36.36	30.77	50.00	30.00
5,000 DA	Intermediate to Moderate (C & E)	45.45	65.38	45.00	70.00
5,000 DA	Slight to Negative (G & H)	13.64	.00	.00	.00
5,000 DA	Inefficient (F)	4.55	3.85	5.00	.00

Note: Because of rounding, totals may not add to 100.

barley. Poorer growing conditions—higher elevation, less rain, infertile soil—encourages barley production, which has a lower controlled price than wheat.

Southern zone farmers, represented by Oum Ladjoul, are the most disadvantaged. In the zone, there is a high risk of late frost. Rainfall averages less than 350 millimeters per year and the soil is shallow and sandy. Barley is the most important crop in the area.

An official list of private farmers of the three communes was made available by the Agrarian Revolution Service of the Wilaya (state) of Setif. An attempt was made to stratify farmers according to size of holdings. However, early it became clear that the actual holdings were quite different (usually larger) than those reported by the Agrarian Revolution Service.⁵ Because it was not possible to determine the exact size of actual individual holdings prior to the survey, farmers were selected at random, based on the list of private farmers of each site. Sixty-eight private (26, 22, and 20 in Oum Ladjou, El-Eulma and Beni Fouda, respectively) and ten "socialist" farmers took part in the experiment.

The measure of risk aversion used in this

experiment is the partial risk aversion coefficient defined as $S = -MU''_w/U'_w = M \cdot A$, where M is the certainty equivalent of a given risky prospect, U'_w and U''_w are the first and second derivatives of $U(W)$, respectively, and A is the absolute risk aversion coefficient defined as $A = -U''/U'_w$ (Pratt). The nonsatiation ($U'_w > 0$) assumptions imply that $A > 0$ and the concavity ($U''_w < 0$) assumptions imply that $A > 0$, that is $S > 0$ if $M \geq 0$, for a risk-averse individual.

Following the work of Binswanger, a constant partial risk aversion (CPRA) function of the form $U = (1 - S)M^{(1-S)}$ was used to approximate the partial risk aversion coefficient, where M is the certainty equivalent of a risky prospect and S is the partial risk coefficient. The partial risk aversion coefficient S is derived by solving the equation for indifference (equal expected utility) between two neighboring alternatives. However, it does not yield a unique value of the parameter S but rather an interval value (table 2). To obtain a unique value for S , the geometric mean of endpoints was used.⁶

⁵ Because of hectareage limitations dictated by the Agrarian Revolution Service, farmers usually declare far below their actual holdings.

⁶ The unique values were as follows: $A = 8.25$; $B = 3.61$; $C = 1.18$; $E = .51$; $G = .158$ (D-W as is equal to the arithmetic mean of the endpoints because the lower bound was 0); $H = 0$ (for logarithmic transformations .005 was used). Alternative F choices were treated as alternative E choices in the regression analysis.

Table 4. Tests of the Risk Distributions in the Four Sites

Distributions: Identification Number	Site	Payoff Scale	A	B	C	E	G	H	F	Number of Observations
1	El-Eulma	5 DA	1	2	8	4	4	3	0	22
2	Oum Ladjoul	5 DA	2	2	8	9	2	2	1	26
3	Beni Fouda	5 DA	2	3	6	7	0	1	1	20
4	Socialist Sector	5 DA	0	1	5	2	1	0	1	10
5	El-Eulma	50 DA	1	2	8	7	2	2	0	22
6	Oum Ladjoul	50 DA	2	2	12	8	2	0	0	26
7	Beni Fouda	50 DA	0	7	11	1	1	0	0	20
8	Socialist Sector	50 DA	0	1	5	3	1	0	0	10
9	El-Eulma	200 DA	1	3	10	4	2	1	1	22
10	Oum Ladjoul	200 DA	1	5	15	3	1	0	1	26
11	Beni Fouda	200 DA	1	6	9	3	0	0	1	20
12	Socialist Sector	200 DA	0	2	4	4	0	0	0	10
1'	El-Eulma	1,000 DA	2	4	8	4	1	1	2	22
2'	Oum Ladjoul	1,000 DA	3	4	10	6	3	0	0	26
3'	Beni Fouda	1,000 DA	2	7	7	3	0	0	1	20
4'	Socialist Sector	1,000 DA	0	3	5	2	0	0	0	10
5'	El-Eulma	5,000 DA	2	6	8	2	2	1	1	22
6'	Oum Ladjoul	5,000 DA	3	5	12	5	0	0	1	26
7'	Beni Fouda	5,000 DA	2	8	7	2	0	0	1	20
8'	Socialist Sector	5,000 DA	0	3	5	2	0	0	0	10

Distributions tested: Test Identification No.	χ^2	Degrees of Freedom	Test Identification No.	χ^2	Degrees of Freedom
1 vs. 2 vs. 3 vs. 4	12.32	18	5 vs. 6 vs. 7 vs. 8	19.30	18
1 vs. 2	3.81	6	5 vs. 6	2.88	6
1 vs. 3	7.55	6	5 vs. 7	11.00	6
1 vs. 4	4.63	6	5 vs. 8	1.69	6
2 vs. 3	2.32	6	6 vs. 7	9.98	6
2 vs. 4	3.36	6	6 vs. 8	.88	6
3 vs. 4	5.09	6	7 vs. 8	4.96	6
9 vs. 10 vs. 11 vs. 12	11.71	18	10 vs. 11	1.83	6
9 vs. 10	2.65	6	10 vs. 12	4.58	6
9 vs. 11	4.10	6	11 vs. 12	3.06	6
9 vs. 12	3.79	6			
1' vs. 2' vs. 3' vs. 4'	13.46	18	5' vs. 6' vs. 7' vs. 8'	12.96	18
1' vs. 2'	4.51	6	5' vs. 6'	5.07	6
1' vs. 3'	3.26	6	5' vs. 7'	3.25	6
1' vs. 4'	3.48	6	5' vs. 8'	3.70	6
2' vs. 3'	5.85	6	6' vs. 7'	2.75	6
2' vs. 4'	3.35	6	6' vs. 8'	1.93	6
3' vs. 4'	2.02	6	7' vs. 8'	2.55	6

To circumvent the problem of raising a negative number, i.e., the loss, to a negative power ($1 - S < 0$ if $S > 1$), the value of the game was added to all payoffs of the game. For example, for the 200-DA level shown in table 2, a value of 200 was added to each payoff. This procedure may be challenged if one assumes that the utility function is over gains and losses, rather than over ultimate wealth; that is, if the asset integration hypothesis is rejected

(Kahneman and Tversky). Translating the payoffs upward by a constant may not preserve the subject's true preferences. However, the translation of the payoffs to the positive branch of the utility function does not imply that the subjects treat opportunity losses and direct losses as essentially the same.

In studying the behavior of an individual, the partial risk aversion parameter becomes relevant when initial wealth is maintained con-

Table 5. Effect of Payoff Scale on Partial Risk Aversion

Game Scale	Mean S Small Scale	Mean S Large Scale	t	Degrees of Freedom
El-Eulma				
5 vs. 50 DA	1.25	1.30	-.10	42
5 vs. 200 DA	1.25	1.53	-.50	42
5 vs. 1,000 DA	1.25	1.98	-1.14	42
5 vs. 5,000 DA	1.25	2.24	-1.56	42
50 vs. 200 DA	1.30	1.53	-.41	42
50 vs. 1,000 DA	1.30	1.98	-1.06	42
50 vs. 5,000 DA	1.30	2.24	-1.48	42
200 vs. 1,000 DA	1.53	1.98	-.71	42
200 vs. 5,000 DA	1.53	2.24	-1.12	42
1,000 vs. 5,000 DA	1.98	2.24	-.38	42
Oum Ladjoul				
5 vs. 50 DA	1.48	1.62	-.24	50
5 vs. 200 DA	1.48	1.77	-.54	50
5 vs. 1,000 DA	1.48	2.09	-.94	50
5 vs. 5,000 DA	1.48	2.30	-1.28	50
50 vs. 200 DA	1.62	1.77	-.28	50
50 vs. 1,000 DA	1.62	2.09	-.73	50
50 vs. 5,000 DA	1.62	2.30	-1.07	50
200 vs. 1,000 DA	1.77	2.09	-.54	50
200 vs. 5,000 DA	1.77	2.30	-.91	50
1,000 vs. 5,000 DA	2.09	2.30	-.31	50
Beni Fouda				
5 vs. 50 DA	1.92	1.94	-.03	38
5 vs. 200 DA	1.92	2.12	-.29	38
5 vs. 1,000 DA	1.92	2.60	-.90	38
5 vs. 5,000 DA	1.92	2.63	-.95	38
50 vs. 200 DA	1.94	2.12	-.36	38
50 vs. 1,000 DA	1.94	2.60	-1.10	38
50 vs. 5,000 DA	1.94	2.63	-1.17	38
200 vs. 1,000 DA	2.12	2.60	-.71	38
200 vs. 5,000 DA	2.12	2.63	-.76	38
1,000 vs. 5,000 DA	2.60	2.63	-.04	38
Socialist Sector				
10 vs. 50 DA	1.12	1.12	.00	18
10 vs. 200 DA	1.12	1.39	-.57	18
10 vs. 1,000 DA	1.12	1.77	-.13	18
10 vs. 5,000 DA	1.12	1.77	-1.28	18
50 vs. 200 DA	1.12	1.39	-.57	18
50 vs. 1,000 DA	1.12	1.77	-1.28	18
50 vs. 5,000 DA	1.12	1.77	-1.28	18
200 vs. 1,000 DA	1.39	1.77	-.67	18
200 vs. 5,000 DA	1.39	1.77	-.67	18
1,000 vs. 5,000 DA	1.77	1.77	.00	18

stant whereas the scale of the gamble is varied by a scaler *k*. An increasing value of *S* relates to the decrease in the willingness to accept a gamble as the scale of the gamble increases. In the course of the experiment, payoff scale was varied by a factor of 40 (real games) and 1,000 (hypothetical games), whereas mean wealth

Table 6. Means of Independent Variables Used in Regression

Variable	Unit	El-Eulma	Oum Ladjoul	Beni Fouda
Age	Years ^a	49.54	47.07	52.35
Schooling	Years ^a	1.40	1.67	0.60
Work age children	Ratio ^b	0.15	0.12	0.25
Herd size	Head	27.27	48.07	33.55
Area cropped	Hectares	15.79	27.25	18.47
Tractors	Number	0.27	0.42	0.40
Radio/TV	Dummy	0.73	0.81	0.81
Gross income	1,000 DA	49.09	27.78	38.80

^a In years of decision maker.

^b Ratio of working age children to total children in the household.

(proxied by average annual gross income) was left virtually constant. (The highest payoff given to the subjects was 200 DA, which only increased mean wealth by a factor of .005). The risk measure (*S*) was independently proposed by Menezes and Hanson, and Zeckhauser and Keeler.

Results and Implications

The intermediate-to-moderate risk class together (table 3) contains 50% or more of the choices in all four sites (an exception is at Beni Fouda, where only 45% of the subjects chose this class at the 5,000-DA level). The extreme to severe risk aversion class contains between 15% of choices at the 5- and 50-DA levels and up to 36% of the choices for the higher payoff scales in three sites (El-Eulma, Oum Ladjoul and Socialist Sector). In Beni Fouda, between 25% and 50% of the choices were in the severe-to-extreme category at the higher payoff scales. These results contrast with Binswanger's experiment where at most 15% of the subjects chose the severe to extreme category.

In any given round, no more than 10% of the subjects selected the inefficient alternative *F*. The selection of this alternative varied with the site.

The homogeneity of various risk attitude distributions was tested using Pearson's chi square test (table 4). The hypothesis that the distributions are independent of the site could not be rejected at the 5% probability level. That is, farmers, regardless of site, exhibited similar pure risk attitudes for the considered payoff levels.

Table 7. Risk Attitudes Explained by Socioeconomic Factors

	5 DA	50 DA	200 DA	1,000 DA	5,000 DA
Age	.0110 (.0208) ^a	0.195 (.0130)	.025** ^b (.0117)	.0192 (.0140)	.0222 (.0133)
Schooling	-.0523 (.1072)	-.1168* (.0671)	-.0050 (.0603)	.0295 (.0721)	.0215 (.0683)
Work age child	-1.208 (1.544)	-2.3860** (.9668)	-.6801 (.8684)	-.4431 (1.0388)	-.1851 (.9841)
Herd size	.0002 (.0075)	.0073 (.0047)	-.0026 (.0042)	.0007 (.0051)	.0008 (.0048)
Area cropped	-.0002 (.0180)	-.0154 (.0112)	-.0085 (.0101)	-.0207* (.0121)	-.0217* (.0114)
Tractor	-.2777 (.5206)	-.3963 (.3259)	-.2464 (.2928)	.2512 (.3502)	.2733 (.3318)
Site 1 (El-Eulma)	-.8883 (.6223)	-1.3194** (.3896)	-.7664** (.3500)	-.6758 (.4186)	-.6248 (.3966)
Site 2 (Oum Ladjoul)	-.3887 (.6082)	-.4361 (.3808)	.2224 (.3421)	-.3287 (.4092)	-.0029 (.3877)
Radio/TV	.5755 (.5992)	.2190 (.3751)	.0061 (.3369)	-.1925 (.4031)	-.0548 (.3819)
Gross income	.0045 (.0055)	.0040 (.0034)	.0034 (.0031)	-.0013 (.0037)	.0014 (.0035)
Constant	-.8763	-.0733	-.5074	.2104	-.2023
R ²	.0738	.2929	.1962	.1300	.1506
F	.454	2.361	1.361	.851	1.010
Number of observations	68	68	68	68	68

^a Standard errors in parentheses.

^b Single asterisk indicates significant at the 10% level; double asterisk indicates significant at the 5% level.

The results also do not support the existence of sharp differences in farmers' willingness to take risk due to institutional (private versus socialist) arrangement. Private and socialist decision makers were equally risk averse. This does not mean that there is no difference in the risks farmers take, particularly between private and socialist farmers; such differences, however, probably relate to their constraint set—equipment, labor, input, and credit availability—not to their willingness to take risk.

Impact of Payoff Scale

Past studies in developing countries (Binswanger (1981); Sillers; Walker) indicate that, often, subjects' choices tend to shift to the more risk-averse alternatives as payoff scale rises, thus implying an increasing partial risk aversion. Menezes and Hanson also predict that individuals with positive wealth who are risk averse will become more so as the game scale rises.

This shift is only partially supported by the results of this study (table 5). Socialist sector farmers, regardless of payoff scale, maintained

their intermediate and moderate risk aversion status. However, there appeared to be an upward shift to the extreme-to-severe class on the part of private farmers. This observed shift in *S* raises the question, "Would an increasing partial risk aversion (IPRA) utility function be more appropriate in representing individuals' behavior?" To answer the question, risk aversion coefficients derived through both the IPRA and the CPRA functions (at all payoff scales) could be compared. However, the CPRA as used in this study is simply a local approximation of partial risk aversion for individuals who are indifferent between two payoffs. No claim is made that the partial risk aversion is globally constant, nor about the form of the utility function.⁷

Regression of Personal Characteristics on Partial Risk Attitudes

In an attempt to explain variations in risk attitudes, the log of the coefficient of risk aver-

⁷ The authors owe this point to an anonymous reviewer.

sion, S , was regressed against eight independent variables (age, schooling, working age children, herd size, area cropped, number of tractors owned, radio and/or TV owned, and gross income) and two dummy variables representing the El-Eulma and Oum Ladjoul sites (table 6). The regression was performed on each of the rounds. The Socialist Sector data were omitted.

The explanatory power of the estimated regressions (R^2) was low, and the effects of the explanatory variables were mixed (table 7). Similar results were obtained when each site was evaluated separately (Belaid). There is some evidence, however, that the number of years of formal schooling, the percentage of working age children, and area cropped were inversely associated with risk aversion. These results are consistent with prior expectations because schooling and cropping areas could be proxies for wealth. More schooling, more working age children, and larger cropping areas presumably would reduce aversion to risk taking. The negative influence of the El-Eulma site variable may be explained by the higher mean gross income of the El-Eulma farmers (table 6).

The generally insignificant results are consistent with previous studies. Binswanger (1980) and Walker obtained generally insignificant results when they regressed the risk aversion coefficient at various game levels against farmers' socioeconomic attributes. Mason and Halter and later Whittaker and Winter obtained conflicting results when they attempted to regress the Pratt coefficient on selected socioeconomic variables for Oregon (USA) grass seed farmers.

While the regressions do not show strong relationships, the results are important. As suggested by Binswanger (1980, p. 406), when explaining his generally insignificant results, "It is not the innate or acquired tastes that hold the poor back but external constraints." Thus, policies oriented to helping the poor must be directed to removing the external constraints that limit their choices.

Conclusions

From the research, it is concluded that farmers in the high plateau region of Algeria unambiguously exhibit risk-averse attitudes. This is generally consistent with previous results of

similar experiments conducted in other developing countries (Binswanger (1981); Sillers; Walker). There is, however, a higher concentration of Algerian farmers in the extreme to severe risk aversion class. This higher concentration was evident even at low payoff scales.

As payoff scale rises, farmers' partial risk aversion coefficients do not significantly increase, though there is a nonsignificant leftward shift in private farmer partial risk aversion coefficient distributions. The results also do not support any intrinsic difference in farmers' pure risk attitudes between sectors (private, socialist) or sites. Thus, any difference in farming practices is likely to arise from differing constraint sets. Based on the similar distribution of risk attitudes across regions and sectors, and the general nonsignificance of socioeconomic variations in explaining changes in the partial risk aversion coefficients, recommending different technologies on the basis of perceived different farmer attitudes to risk in the two agricultural sectors or in the three agroecological zones appears to be inappropriate.

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