RISK ATTITUDES OF FARMERS IN MAHABUBNAGAR DISTRICT OF ANDHRA PRADESH AND THEIR DETERMINANTS

D.KUMARA CHARYULU* AND K.P.C RAO**

ABSTRACT

Understanding the attitudes of farmers toward risk is important in understanding their decision making processes. It helps in accelerating the adoption of new technologies and agricultural development. There exists a huge gap in our knowledge of farmers' risk attitude and their association with the personal characteristics of the farmers. The present study has been undertaken to study the risk attitudes of 80 farmers from four villages in Mahabubnagar district of Andhra Pradesh. The risk attitudes of the farmers were assessed by using experimental methods involving trivial but real payoffs to them. Mean-variance (E-V) utility function was used to calculate the risk aversion coefficients based on the alternative outcomes chosen by the sample farmers. The study found that slight to moderate risk aversion exists in most of the sample farmers. The slight reduction in risk attitudes between 2004 and 2006 was found to be associated with higher rainfall, better access to credit and insurance and improved levels of yields and income. Age of household head and family size were noted to increase risk aversion significantly.

1. Introduction

Risk and uncertainty are indispensible elements of life. Risk is measured either as the variability in returns or as the probability of loss (Hardaker et al.,2004). Since the performance of agriculture, in general, and dry land agriculture, in particular, depends on the quantum and distribution of rainfall; it is quite common for the actual returns to deviate from the anticipated returns or to fall short of the costs of production. The degree of risk is much higher in dry land agriculture than in irrigated farming as the latter minimizes production risks. Several studies have shown that yield risk is more important in dry land agriculture while price risks are dominant in irrigated farming (Walker and Ryan, 1990). Studies have also proved that most farmers are risk averse when they have to stake large investments in farming (Binswanger, 1978a &b). It does not mean that farmers do not take risks. They only need a promise of higher returns when they go for activities with risky outcomes. It is the return-risk trade-off that influences the farmers' decisions. Higher the expected money value of the possible alternative outcomes, farmers would be willing to go for more risky propositions. Risk attitudes of the farmers are very much important in the choice of enterprises and technologies. Risk aversion is known to slow down the adoption of innovations, which entails some risk, unless it offers sufficiently

*Consultant, GT-IMPI, ICRISAT, Patancheru, A.P, Pin: 502324
**Principal Scientist (VLS), GT-IMPI, ICRISAT, Patancheru, A.P

higher returns per a given level of variability. It is essential to gain an insight in to the dispersion of risk attitudes among the farmers to decide whether different strategies are needed to attract different categories of farmers with reference to their risk preferences. The objective of the present paper is to study the risk attitudes of farmers by playing experimental games. Research questions like whether the risk attitudes of farmers are consistent over a period of time; whether the choices made by respondents differ when they play hypothetical and real games; whether buying an rainfall insurance policy has any influence on their risk attitude and whether risk attitude of an individual is a personal trait or is it influenced by any socio-economic characteristics etc are explored in it.

2. Sample for the Study

Mahabubnagar district of Andhra Pradesh was purposively selected for the present study since it is one of most drought prone districts of Telengana region of the state. The pilot introduction of rainfall insurance schemes in kharif, 2003 and its subsequent marketing in kharif, 2004 and kharif, 2006 were the other factors that influenced the selection of the district. Experimental games were played in these two seasons with 80 sample farmers from the district using a multistage random sampling technique. Two mandals namely, Mahabubnagar and Atmakur were selected randomly from five mandals in the district where rainfall insurance policies were marketed. From each mandal, two villages were selected. One of these villages was drawn from the villages where rainfall insurance policies were marketed. The second village was randomly selected from the villages where rainfall insurance policies were not marketed to serve as a control. Twenty farmers were drawn randomly from each these four villages thus selected. Thus, there was a total sample of 80 farmers. One-half of them came from treated villages and the other-half represented control villages (table 1).

Table 1 Details of the Sample

Name of the district	Mandal	Village	Game payment status in 2004-05	Game payment status in 2006-07
Mahabubnagar (T)	Mahabubnagar (T)	Dharmapur (T)	Real	Real
		Divitipally (C1)	Real	Real
	Atmakur (T)	Pamireddypalli (T)	Real	Real
		Pinnamcherla (C1)	Hypothetical	Real

(T) : Exposure to rainfall insurance policies

(C1): No direct exposure to rainfall insurance but might have had some knowledge about the products indirectly

3.Methodology

An experimental technique to measure attitudes towards risk has practically no theoretical restrictions; individuals choose among alternatives where increasing expected returns can only be purchased by increasing risk or dispersion of outcomes. In contrast to the techniques used in experimental psychology (Edwards ward, 1953) and elicitation methods used in economics (Anderson et al, 1977), Binswanger (1978) used experimental

methods involving trivial to substantial real payoffs to induce participants reveal their preferences. We used the same method of Binswanger but involving only trivial payoffs. For this purpose, risk attitude games involving six alternative outcomes were played with each of the respondent in the sample. It was believed that the choice of the respondent from these six alternative outcomes would reflect his/her risk attitude. A coin was tossed to determine whether the respondent has won (called it right) or lost (called it wrong). These risk attitude games were played with the sample farmers in two time periods i.e., at the end of kharif season of 2004-05 and at the end of kharif season of 2006-07. The payment methods (real/hypothetical) were also varied to assess the influence of the game payout on their risk attitudes. Real payout games were played in case of three out of four villages in the sample, while hypothetical game (with out real payment) was played in 2004-05 in case of the fourth village. During 2006-07, real games were played in case of all the four villages.

Mean-variance utility function

For the calculation of risk aversion coefficient (γ), mean-variance utility function was applied (Markowtiz, 1952).

The form of the function is $U(c) = E(c) - \frac{1}{2} \gamma V(c^o)$

Where E (c) = Mean value specified as

$E(c) = \mu = \frac{1}{2} X_L + \frac{1}{2} X_H$

X_L = lower level payout (bad luck)

X_H = higher level payout (good luck)

$V(c^o)$ = variance specified as

$V(c^o) = \frac{1}{2} [X_L - \mu]^2 + \frac{1}{2} [X_H - \mu]^2$

Calculation of risk aversion coefficient

The risk aversion coefficient (Y) was computed for each game option by taking the mean of the two possible alternative game outcomes and the variance attached with them. The upper bound value of risk coefficient was taken as '+ ∞' for option 'a' while its lower bound value was computed as 0.044 (for movement from 'a' to 'b'). For practical purpose, its lower bound value was taken as the 'Y' coefficient for option 'a'. For option 'b', the upper bound value of 'Y' coefficient was 0.044 (the same as lower bound value of 'Y' in option 'a') and the lower bound value was computed as 0.0125 (for movement from 'b' to 'c'). The mean of these two values was taken as the 'Y' coefficient for option 'b'. The same procedure was followed for options 'c','d' and 'e'. In case of option 'f,' since the upper bound value was tending to negative, it was taken as '0' and the lower bound value was assumed as '-∞' (for movement from 'e' to 'f'). For practical

purpose, the assumed upper bound value of '0' was taken as the 'Y' coefficient for option 'f'. The details of the game options, the pay-offs, the associated risk classifications and risk coefficients computed using E-V method are summarized in table 2.

Table 2:The Game Options, Pay-offs and Corresponding Risk Classification

Option	Low pay-off	High pay-off	Risk aversion class	'Y' coefficient values (E-V) method
A	50	50	Extreme	0.0440
B	40	100	Severe	0.0282
C	30	130	Moderate	0.0104
D	20	160	Slight	0.0057
E	10	190	Risk neutrai	0.0015
F	0	200	Risk–neutral to negative	0

Multiple Linear Regressiou Model

The risk aversion coefficient was regressed on the socio-economic characteristics of sample farmers.

$$Y= a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+b_8x_8+U_t$$

Where

Y = Risk aversion coefficient

x_1 = Education level of household head (years of schooling)

x_2 = Age of household head (in years)

x_3 = Total wealth of household (in Rs)

x_4 = Off-farm income per year (in Rs)

x_5 = Size of the family (number)

x_6 = Caste/religious category (1=Other caste, 2=Backward caste, 3=Scheduled caste, 4=Scheduled tribe and 5=Minority)

x_7 = Dummy for treated villages (1: where rainfall insurance policies were marketed and 0: where they were not marketed)

x_8 = Dummy for insurance participation (1: for households covered by crop loan insurance and 0: for those which were not covered)

The multiple linear regression models were estimated by the method of least squares.

4. Results and Discussions

The pattern of distribution of risk attitudes of the sample farmers in the district is presented in table 3. Pamireddypalli, which is a progressive village and with a bore well users association functioning and there by, having the experience of collective action, exhibited much less risk aversion when compared with the other three villages. The pooled sample of treated villages exhibited less risk aversion than that noted in the control villages during the base year, 2004.

Table 3 Distributions of Risk Attitudes in Sample Households

Village	Period and nature of game	Risk aversion class						
		Extreme (a)	Severe (b)	Moderate (c)	Slight (d)	Risk-neutral (e)	Neutral to negative (f)	Total Sample
Pinnamcherla (C_1)	2004	7 (35)	10 (50)	1 (5)	2 (10)	0 (0)	0 (0)	20 (100)
	2006	1 (5)	5 (25)	9 (45)	5 (25)	0 (0)	0 (0)	20 (100)
Pamireddypalli (T)	2004	2 (10)	9 (45)	3 (15)	4 (20)	1 (5)	1 (5)	20 (100)
	2006	1 (5)	4 (20)	4 (20)	5 (25)	5 (25)	1 (5)	20 (100)
Divitipally (C_1)	2004	6 (30)	8 (40)	5 (25)	1 (5)	0 (0)	0 (0)	20 (100)
	2006	0 (0)	5 (25)	9 (45)	3 (15)	2 (10)	1 (5)	20 (100)
Dharmapur (T)	2004	6 (30)	11 (55)	2 (10)	1 (5)	0 (0)	0 (0)	20 (100)
	2006	2 (10)	7 (35)	4 (20)	4 (20)	2 (10)	1 (5)	20 (100)
Total sample	2004	21 (26)	38 (48)	11 (14)	8 (10)	1 (1)	1 (1)	80 (100)
	2006	4 (5)	21 (26)	26 (33)	17 (21)	9 (11)	3 (4)	80 (100)
Control	2004	13 (32.5)	18 (45)	6 (15)	3 (7.5)	0 (0)	0 (0)	40 (100)
	2006	1 (2.5)	10 (25)	18 (45)	8 (20)	2 (5)	1 (2.5)	40 (100)
Treated	2004	8 (20)	20 (50)	5 (12.5)	5 (12.5)	1 (2.5)	1 (2.5)	40 (100)
	2006	3 (7.5)	11 (27.5)	8 (20)	9 (22.5)	7 (17.5)	2 (5)	40 (100)
Hypothetical	2004	7 (35)	10 (50)	1 (5)	2 (10)	0 (0)	0 (0)	20 (100)
Real	2004	14 (23)	28 (47)	10 (17)	6 (10)	1 (2)	1 (2)	60 (100)
	2006	4 (5)	21 (26)	26 (33)	17 (21)	9 (11)	3 (4)	80 (100)

* Note: figures in the parenthesis indicates percentage to total

By 2006, both the control as well as treated villages showed much less risk aversion than in 2004. But, in relative terms, control villages indicated a much sharper fall in risk aversion than the treated villages. To test the significance of the risk attitudes over time, paired 't' test was applied to the responses recorded in 2004 and 2006. It was found that in all the cases the calculated values of 't' exceeded the table values. It implied that there was a significant reduction in the risk aversion levels between 2004 and 2006. In Mahabubnagar district, 2004 was a bad year and respondents who bought rainfall insurance with reference to Atmakur rain gauge received marginal payouts. But in 2006 there were no such payouts. Perhaps two factors contributed to less risk aversion in 2006. One was that the crop performance was slightly better in 2006 than in 2004. The second reason could be that the respondents gained knowledge about the game and felt that they should capitalize on the better expected values associated with risky options.

Influence of Rainfall Insurance on Risk Aversion

In fact, the risk aversion levels in 2006 were a shade lower in control villages than in treated villages. It shows that the sale of rainfall insurance products in the treated villages did not bring about any faster reduction in the level of risk aversion when compared with the same in control villages. It was largely because very low coverage of risk by the rainfall insurance products. Most of the farmers that purchased rainfall insurance have bought a single unit of rainfall insurance which, at best, gives coverage of only Rs.1000 at the exit levels. On an average, a household invests about Rs.30,000 to Rs.40,000 on crops. Thus, the level of risk cover is only to an extent of 2.5 to 3.3 per cent. Moreover, the rainfall insurance products are marketed by private companies and are actuarial in nature. There is no subsidy either on the premium charged or in the form of indemnities paid. Because of very less risk cover obtained from rainfall insurance, treated villages did not show any faster change in risk aversion. In fact, other factors played a major role in reducing the level of risk aversion in both the treated and control villages than the access to rainfall insurance products.

Hypothetical and Real Games

In Pinnamcherla village where hypothetical game (with no transfer of money involved) was played in 2004, the level of risk aversion was higher than what was recorded in the other three villages where real games were played (which involved transfer of money). This result is a bit counter-intuitive as it is believed that people take more risks when hypothetical games are played. Perhaps, it is more due to the differences in resource endowments and incomes levels. As can be noted from table 4, the non-crop income in Pinnamcherla is higher only when compared to Divitipally in 2004. In case of the other two villages, Dharmapur and Pamireddypalli, the non-crop income levels were much higher than that in Pinnamcherla.

Table 4 Household Income other than from Agriculture in 2004-05 and 2006- 07 (Rs per month)

Income item	Pinnamcherla		Pamireddypalli		Divitipally		Dharmapur	
	04-05	06-07	04-05	06-07	04-05	06-07	04-05	06-07
1.Agril.labor	1178	1018	985	829	553	725	270	252
2. Non.agril labor	808	425	1453	675	1970	1010	1566	1895
3. wages from public relief	0	367	0	385	0	236	0	0
4. Non-farm self employment	535	750	588	1500	190	725	1205	1480
5. Sale of handicrafts	0	0	150	0	0	0	0	100
6. Caste occupations	300	125	0	0	0	0	280	0
7. Migration income	200	375	100	1000	0	125	0	0
8. Benefits from Govt.prog	0	160	0	5	0	8	0	129
9.Pensions	11	180	0	50	0	30	175	630
10. Dowry income	0	0	1000	625	0	0	0	0
11. Other income	5	0	500	125	0	121	125	0
Total	3036	3400	4775	5194	2713	2980	3621	4485

5. Rainfall and Crop Performance

The major reason for a sharp reduction in the level of risk aversion in 2006 appears to be the improvement in the quantum and distribution of rainfall during 2005 and 2006. The rainfall received in 2004 was sub-normal and indicated a deficiency level of 39 per cent during the south-west monsoon period and 31.7 per cent deficiency in terms of the total annual rainfall. The rainfall received in 2005 was very high, reporting a surplus of 61 per cent in terms of total rainfall and 36 per cent in terms of the rainfall received in south-west monsoon. Although the rainfall received in 2006 was not as high as that in 2005, it was still 16.1 per cent more than the normal annual rainfall. Even the rainfall received in 2006-07 south-west monsoon was higher by 13.6 per cent when compared with the normal rainfall in the same period. Two successive years of good rainfall might have reduced the level of risk aversion in 2006 when compared with the same in 2004(Table 5).

Table 5 Rainfall during 2004-05 to 2006-07 and Deviations from Normal Rainfall (mm)

Season	Normal	Actual 04-05	% of deviation	Actual 05-06	% of deviation	Actual 06-07	% of deviation
South West monsoon	446.8	272.6	-39.0	609	+36.3	508	+13.6
North East monsoon	121.0	85.0	-29.8	221	+82.6	118	-2.5
Winter period	3.4	3.1	-8.8	0	-100.0	0	-100.0
Hot weather period	33.5	52.1	+55.5	143	+326.9	77	+129.8
Total	604.7	412.8	-31.7	973	+60.9	703	+16.1

The crop performance also improved with the increase in rainfall during 2006 (Table 6). The average yield of paddy reported across the four study villages increased by an average of 16 per cent due to higher water availability. The increase in yield was much higher at 22 per cent in case of the rainfed crop, castor bean.

Table 6 Average Yields of Major Crops during 2004-05 and 2006-07

Village	Paddy (kg/ha)		Castor (kg/ha)	
	2004-05	2006-07	2004-05	2006-07
Pinnamcherla	4199	4458	457	506
Pamireddipalli	4940	5513	494	642
Dharmapur	3658	4014	433	524
Divitipally	2717	4014	309	395
Average	3879	4500	423	517

Access to Credit and Crop Loan Insurance

Except in case of Pinnamcherla where the amount of credit borrowed recorded a marginal fall between 2004 and 2006, the amount of credit availed has increased in all the other three villages (Table 7). On an average, the amount of credit borrowed has increased by 55.3 per cent over the two years period. Since the institutional credit is linked to crop loan insurance, the insurance coverage also increased by the same proportion. Improved access to credit and higher coverage by crop loan insurance has resulted in reduced levels of risk aversion in all the villages other than Pinnamcherla. It has a double effect in the sense that increased access to institutional credit implies lower dependence on non-institutional sources and lower effective rates of interest. Simultaneously, higher coverage by crop loan insurance gives them a confidence that they can with stand the risk of crop failure better.

Table 7 Credit Borrowed from Institutions and Coverage under Crop Loan Insurance (Rs/Hh)

Village	Avg. credit borrowed in 2004-05 (Rs)	Sum assured under crop loan insurance(Rs)	Avg. credit borrowed in 2006-07 (Rs)	Sum assured under croploan insurance (Rs)
Pinnamcherla	12700	19050	12000	18000
Pamireddipalli	29225	43838	66000	99000
Dharmapur	16850	25275	18750	28125
Divitipally	25100	37650	33550	50325
Average	20969	31453	32575	48863

Influence of Socio-economic Characters on Risk Attitudes

We have so far argued that better rainfall regime, higher crop yields and non-crop incomes as well as improved access to institutional credit and crop loan insurance contributed to the reduction in risk aversion levels of sample farmers. Relatively, access to rainfall insurance played a minor role in influencing risk attitudes due to less insurance coverage. Still the age old question whether the risk aversion is an individual trait or is it influenced by socio-economic characteristics of the households remains to be answered.

The results of the multiple regression with risk aversion coefficient ('Y') as the dependent variable and age of the household head, total wealth, off-farm income, educational level, family size and caste category as the explanatory variables provided some interesting results. Along with these independent variables, intercept dummies were used for rainfall insurance participation (sale of rainfall insurance policies) and participation in crop loan insurance (table 8).

Table 8 Factors Influencing Risk Attitudes

Variable	Mahabubnagar
Intercept	139.312*
	(2.925)
Household head age	1.164**
	(1.999)
Total wealth	-0.133
	(-1.262)
Off-farm income	0.0001
	(0.130)
Family size	10.175*
	(3.616)
Caste category	-5.793
	(-0.451)
Education level	0.878
	(0.629)
Dummy for treated village	-14.442
	(-1.186)
Dummy for insurance participation	-4.105
	(-0.340)
Adjusted R-square	0.190
F – value	3.316*
Number of observations	80

Figures in the parenthesis indicates t - values
*Significant at 1 per cent level
** Significant at 5 per cent level

The explanatory power of the equation was rather weak with only 19 per cent of the variation in risk attitudes being explained by all the explanatory variables. Yet, family size and age of the household head did have positive influence on risk aversion. While the coefficient of family size was significant at 1 per cent level, the coefficient of age of the household head was significant at 5 per cent level. It implied that the households with larger family size and with older persons heading the households tended to be more risk averse. On the other hand, the coefficient of total wealth had a negative sign and the 't' value was 1.26. But it was not statistically significant. Similarly, the village dummy for participation in rainfall insurance also had a negative but non-significant coefficient. None of the other explanatory variables had 't' values exceeding unity.

6. Summary and Conclusions

The main conclusion arising from this study is that most of the sample farmers exhibited slight to moderate degrees of risk aversion. Only few farmers were in the neutral to negative class of risk behavior. The risk attitudes were similar to most of the population, despite the differences in income and wealth levels of individuals. The degree of risk aversion decreased considerably between 2004 and 2006. Better familiarity with the games and improved agricultural conditions due to higher rainfall might have caused the reduction in the risk aversion coefficients observed in 2006. Improved access to credit and coverage by crop loan insurance might have also contributed to more risk taking attitudes in 2006.

The participation of farmers' in the rainfall insurance schemes did not reduce the risk aversion levels significantly because of very limited coverage by them. Among the socio-economic characteristics used to explain variation in risk aversion, age of household head and family size generally increased the degree of risk aversion. None of the dummies used to capture the variations in villages, access to rainfall insurance and coverage by crop loan insurance turned out to be statistically significant.

Policy Implications

1.Development of different dry land technologies aimed at farmers having different degrees of risk aversion is not worthwhile because of very limited dispersion noted in risk attitudes of the sample farmers.

2.There are indications that mechanisms like crop loan insurance and rainfall insurance are influencing the risk attitudes but not significantly. They need to be further improved both in content and coverage to make the farmers less risk averse and to promote adoption of technologies.

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