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ATTITUDES TOWARD RISK AMONG SMALL FARMERS in SOUTHERN HUILA

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SUMMARY:

Timely evaluation of new technology performance is extremely important for the international center. As part of the evaluation efforts of new bean technology currently in process at CIAT a mathematical model of the bean farm is being implemented.

One of its features is the incorporation of risk aversion on the farmers objective function. The present paper deals with the methods and results of the elicitation of risk aversion among southern Huila farmers. The results seem to indicate that farmers are generally risk averse when faced with uncertain options. Furthermore, their degree of risk aversion is significantly inverse to subsistence security. Regressions of socioeconomic factors on risk aversion indicate that there is room for risk aversion reduction through policy instruments.

INTRODUCTION

An important aspect of technology generation at the International Centers is the evaluation of the potential benefits of new technology before it is released to the final clients, the farmers. By evaluating its potential adoption at the farm level and the magnitude of the potential benefits it may be possible to make timely modifications at the experiment station with the consequent savings in time and money. For the past year the Centro Internacional de Agricultura Tropical (CIAT) has been involved in the process of ex-ante evaluation of its bean technologies through a series of farm level trials and mathematical modeling of the small farm system. This last element in the evaluation process involves the use of non-linear programming in order to account for risk and its influence on the potential adoption of the new technology. In this respect the correct estimation and interpretation of the farmer's degree of risk aversion or risk preference is of outmost importance[1,2].

The objective of this paper is to present and discuss the methods and results obtained in the procurement of attitudes toward risk among semicommercial farmers in Southern Huila, Colombia. These attitudes will be expressed in terms of risk coefficients which form part of the small farm risk programming model at CIAT.

1/ Dillon, J. L., and P. L. Scandizzo, "Risk Attitudes of Subsistence Farmers in Northeast Brazil: A Sampling Approach", American Journal of Agricultural Economics 60 (August 1978): 425-435.

2/ Binswanger, H. P., N. S. Jodha and B. C. Barah, "The Nature and Significance of Risk in the Semi-Arid Tropics", Workshop on Socioeconomic Constraints of Semi-Arid Tropical Agriculture, ICRISAT, February 1979.

The Risk Coefficient

Although it is clear that farming decisions are affected by the farmers' own attitudes toward risk there is scanty empirical evidence with respect to the magnitude or importance of that effect. The procurement of the risk coefficient relates to the use of synthetic experiences (gambles or games) in which, through a sequence of choices, the attitude towards risk is ascertained. This "experimental measurement" approach has been increasingly applied for studying farmer decision processes in developing agriculture[3]. To apply the approach, it is necessary to assume a special form for the utility function, if a quantitative result is to be obtained for inclusion in a risk decision model. It is of course possible to ascertain whether the respondents are risk neutral, averse or takers by examining the results of the experiment relative to the corresponding certainty equivalent without reference to the utility function[4].

For the present analysis a quadratic utility function is assumed. This is necessary since the objective function for the risk programming model is quadratic. The quadratic utility function can be assumed to approximate other more general functional forms, but itself has undesirable properties related to the restrictions on curvature that it imposes[5]. In applying the

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3/ Binswanger, H. P., "Attitudes Towards Risk: Experimental Measurement in Rural India", Paper #285, Economic Growth Center, Yale University, 1978

Benito, C. A., "Peasants Response to Modernization Projects in Minifundia Economies", American Journal of Agricultural Economics, 58 (February 1976): 143-151.

4/ Binswanger, H. P., N. S. Jodha and B. C. Barah, "The Nature and Significance of Risk in the Semi-Arid Tropics", Workshop on Socioeconomic Constraints of Semi-Arid Tropical Agriculture, ICRISAT, February 1979.

5/ Johnson, S. R., "A Re-Evaluation of the Farm Diversification Problem", Journal of Farm Economics, 49 (August 1967): 610-621.

function to measure risk aversion attitudes, it will be assumed that the approximation is taken over the region of the quadratic function with a positive first derivative.

The method employed to determine the value of the risk aversion coefficient is similar to that applied by Dillon and Scandizzo in northeast Brazil. Differences relate to:

1) the fact that all the questions were administered by an individual familiar with the way in which the method is applied to determine the risk aversion coefficient, thus greatly reducing interview bias, and
2) the fact that a risk aversion coefficient was determined for two different types of experiments, each associated with different stakes.

The object of this latter exercise was to provide information on the constancy of the risk aversion coefficient across larger chances, in the Bernoullian tradition.

The two experiments administered to the farmers are described in more detail in the appendix. The first experiment involves the use of coins. Pretest of the schedule with farmers indicated that they find it attractive to participate in experiments that involve physical objects. For this experiments, three piles of coins are used. The farmer is asked to choose between one pile that will be received with certainty and two piles that he will receive with a probability of 0.5 each. The probability level is communicated by indicating that the farmer will receive one or the other of the latter two piles of coins depending on the outcome of a coin toss. Depending on the choice made, the pile of coins to be received with certainty is reduced or increased until a point of indifference is obtained.

The second experiment involves the choice between two hypothetical, but realistic options. The first option is one in which the farmer receives a certain amount of cash in excess of that required for the family to subsist. This amount was tailored to each farmer depending on his actual needs. The second option is one which in three or four years gives a higher return than the necessary to sustain the family. However, for one of four years this amount is considerably smaller than the amount received with certainty. The interviewer asks the farmer to choose between the options and then adjusts the certain option based on the responses until a point of indifference is found.

The points of indifference obtained from each experiment is employed to calculate a coefficient of risk aversion. In broad terms this is done as follows: Let Q_E be the value of the certainty equivalent. Given the quadratic utility assumption, the implied risk aversion coefficient is determined by solving the equation

$$Q_E = \bar{X} + rV$$

or

$$r = \frac{Q_E - \bar{X}}{V}$$

where $\bar{X}$ is the mean returns, V is the variance and r is the risk coefficient. Clearly, if the certainty equivalent is less than the mean, the farmer will be risk averse.

Data

The analysis is based on interviews performed on 31 semi-commercial and commercial farmers in Southern Huila, Colombia. This region produces about 30 percent of the dry beans produced in the country and has, for the past two years, been utilized as a pre-release testing grounds for CIAT's bean technology. Southern Huila has an area of approximately 2000 km^2 with altitudes varying from 900 to 1300 meters above sea level and with a mean temperature of 22C°. Most of the land is steeply sloped though there are valleys suitable for mechanization. The rainy reason is bimodal with two rainy periods of three to four months each starting in March and October respectively. Average humidity is 75 percent. Southern Huila has a relatively high proportion of small holdings with ownership being the predominant form of land tenure. The typical family farm is composed of seven to 10 members with approximately two adult-equivalent family labor units per farm[6].

Farms are relatively small. Approximately 54 percent of the farms are under 5 hectares and 82 percent under 20 hectares[7]. Cassava, corn and plantains are the predominant home consumed items while coffee, beans and brown sugar from sugarcane are the main commercial items. Tomatoes and onions are also produced but as a special case. They are, in most cases, produced for sale at big-city terminal markets by farmers specialized in these crops. Table 1 lists the main characteristics of the sample population. The magnitude of the figures are very similar to the average figures reported in other studies[8].

6/ Instituto Colombiano Agropecuario (ICA). Regional 6. Distrito de Transferencia de Tecnología Sur del Huila, Diagnóstico Distrital. Ibagué, Colombia, 1978.

7/ Departamento de Administración Nacional de Estadísticas (DANE). Censo Agropecuario, Bogotá, Colombia, 1972.

8/ Instituto Colombiano Agropecuario, op.cit.

Ruiz de Londoño, N., P. Pinstrup-Andersen and M. Infante. Estudio agroeconómico de los procesos de producción de fríjol (*Phaseolus vulgaris*) en Colombia. CIAT, Cali, Colombia (forthcoming).

The farmers interviewed were selected from among the participants in the CIAT on-farm trials and among farmers receiving technical assistance from the ICA Regional 6 office. While the sample is not random, substantial efforts were made to interview farmers who were fairly representative for the area. As a consequence, the characteristics of the sample population are expected to closely resemble the regional averages (Table 1).[1] Most of the farmers are middle aged with very little formal education, specially among the older farmers. Most of them own their holdings and do very little work outside the farm. This latter behavior is consistent with farmers' assertion about farming experience. According to the farmers interviewed the pattern is for young men to work as hired hands for a few years beginning in their late teens, and then to acquire land soon after starting a family when they reach their late twenties. As a consequence, off-farm work or work as hired farm labor is more dominant among younger farmers.

Another aspect worth mentioning is the interrelationship between age and schooling. Due to the past infrastructural defficiencies older farmers have, in general, less years of formal schooling than younger ones. A simple data appraisal would therefore suggest that formal schooling is directly related to increased risk aversion. A more correct interpretation, however, is to look at schooling as another indicator of age effects.

Interview Results

The farmers' willingness to play the interview games was not a problem since they were acquainted with the questioner through the on-farm trials. In general, farmers reacted more seriously toward the income gambles than toward

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1/ For more details on the regional characteristics see Instituto Colombiano Agropecuario (ICA). Regional 6. Distrito de Transferencia de Tecnología Sur del Huila, Diagnóstico Distrital. Ibagué, Colombia, 1978.

the coin game. This was probably due to the more realistic nature of the risky income situation. The estimated risk aversion coefficients are shown in Table 2. As the table indicates, farmers had problems in conceptualizing the nature of the gambles. Not only the coefficients are spread over a wide interval but about half of the farmers interviewed showed some degree of inconsistency between the games. The degree of risk aversion when the game included uncertainties with respect to family sustenance was, for approximately half the farmers, lower than risk aversion under assured subsistence. It is suspected that inconsistent farmers either did not understand the gambles or were not internally consistent because of the strongly monetary nature of the questions. It is unusual for semisubsistence farmers to think of the home consumed products in terms of market prices. These products include house rent, transportation, and some food products. In asigning a monetary value to these goods the inverviewer may have a monetary value which, while correct, may sound excessive to a farmer who is not used to peg the value of the goods to a current market price. Hence, when faced with a question which ask them to allocate their total expenses in terms of a given monetary income some farmers may feel at loss and thus bound to behave inconsistently[1]. The fact that inconsistencies do arise even when interview bias is minimized, as in this case, poses serious questions as to the viability of risk procurement methods such as income gambles[2]. Nevertheless, the results from the interviews indicate that farmers are generally risk averse when faced with a risky total income and approximately neutral when their sustenance is asured. These results are consistent with the ones obtained by Dillon and Scandizzo in a similar context.

1/ Further evidence in this regard is the fact that the inconsistency is relegated to the games only, as indicated by the similarities in the socioeconomic characteristics of the consistent farmers. See Table A.1 in the Appendix.

2/ Dillon, John L., and Pasquale Scandizzo. 1978. op.cit.

Risk Aversion in a Small Farm Context

Only a few studies exist on the socioeconomic characteristics affecting risk aversion. Moreover, the two main experimental procedures used —betting, and income gambles— have failed to provide an empirical base with respect to risk aversion prediction based upon socioeconomic variables. Reasons given for this failure fall into the categories of interview bias and/or "one-period money" effects[1]. The elicitation methods for southern Huila were expected to account for the former problem by utilizing a single interviewer with knowledge on the subject of risk aversion. The latter problem, inherent in gambles of this nature, cannot be entirely avoided. Gamble results are biased in the sense that the degree of risk aversion is directly related to the degree of imperfection in the capital market. The bias will be more pronounced if the gamble operates on a range where the farmer does not need to either borrow or lend to attain such income[2]. Under the above rules it is clear that only the coins game fall into this area. The income gambles proposed to the farmer under the Dillon and Scandizzo method were tailored to the specific income needs of each farmer interviewed. Such incomes do include borrowing and/or lending capabilities and are therefore excluded from "one-period money" bias. The use of both methods, coin games and income gambles, then becomes useful for a consistency check of risk aversion.

Differences in the magnitude of the risk coefficient attributable to each methodology were found significant between the two income-subsistence games. In addition, no difference was found between the coins game and the game of subsistence at risk. Nevertheless, the lack of a statistical difference in the latter case does not indicate that the coins game, a simple elicitation method, may be used in substitution of the subsistence at risk game. The

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1/ Binswanger, Hans. 1978, op.cit., p.35

Roumasset, James; Jean-Mark Boussard and Inderyit Singh, (eds.). Risk, Uncertainty and Agricultural Development. Agr. Dev. Council, New York, 1978.

Masson, Robert R. The Creation of Risk Aversion by Imperfect Capital Markets. American Economic Review, 62 (1972): 77-86.

2/ Masson, R. T., 1972, op.cit., p.81.

theoretical limitations imposed by capital market imperfections is a precluding factor, plus the fact that the game produces a risk coefficient of little significance in terms of relationships with the socioeconomic environment as it will be seen in the following section.

Aside from the risk programming consideration the risk coefficient should give an indication of how risk aversion can be spread or transferred away from the farm unit. The policy implications of modeling risk aversion are fairly obvious. If risk transfer is an objective of farm policy, then policy instruments can be geared toward those variables affecting risk aversion the most.

Measuring Risk through Income Gambles

The effect of socioeconomic characteristics on risk aversion is shown in Tables 3 and 4. Of the three OLS regressions shown in the table the equation for the coins game offers the least explanatory power. Given this fact and the theoretical challenges facing the results from "one-period money" games, the discussion will be focused on the results for the gambles involving income. The OLS results for the income-subsistence methods show that socioeconomic factors are indeed significant in terms of risk aversion. In order of coefficient magnitude the results show that:

Crop tenure is a dummy variable measuring the effect of co-owning a crop on the degree of aversion to risk. Crop ownership is dependent on wealth, credit availability, land ownership and labor requirements for the crop. Given the high cost of capital for the region, sharing the production of a crop is a good way to decrease the capital requirements and share the risks associated with production.

An effect working in the opposite direction of risk aversion is the utilization of new inputs. The Level of Technology variable is a dummy variable which takes a value of 1 if the farmer uses at least two of the following inputs: fertilizer, hybrid corn seed, fungicide, and row planting of beans. This variable, however, is in turn affected by risk aversion since it attempts to measure a degree of technical innovation. Clearly, farmers who are averse to risk are expected to be less innovative than risk neutral or risk loving farmer. However, if the simultaneity between risk aversion and innovation is ignored the results suggest that the use of new inputs does not increase risk aversion. A similar problem is found with the income variable. Income is measured in terms of gross margins generated by all the production enterprise on the farm, plus any off-farm or hired labor income that the farmer was able to obtain. It depends heavily on other factors such as credit, input availability, land quality, quality of the extension service and so forth, which are important in deciding which inputs to use. Coffee farmers, for instance, recognize that the use of fungicide —a relatively sophisticated input in traditional farming— is necessary in order to increase coffee production. Nevertheless, they also point out capital scarcity as the reason for not using fungicide with a corresponding decrease in income from coffee.

All this seems to suggest that the relationship between risk aversion and the farming environment is more complex than the linear relationships presented in Table 3. As it is, the OLS model present coefficients which have the proper magnitude and sign even in the case of the income and schooling variables. Contrary to what it is expected, the sign of the income coefficient is negative, indicating a direct relationship to risk aversion.

A plausible explanation for the discrepancy is an apparent ratchet effect among farmers with respect to income. As income increases so does the risk premium used by the farmer in his decision making process, thus behaving in a more risk averse fashion. Such behavior is perfectly possible considering that income increases are only attainable through increments in farm production. Since the level of technology currently in use varies only in modest proportions then the risk taking effect of income is being picked up by the wealth variable through the use of more land. Age indicates that as farmers get older they become more risk averse. And so does formal education. As discussed previously, younger —and presumably less risk averse— farmers tend to have more years of schooling than older farmers; hence the negative coefficient for schooling. The effect of education is represented by the years of experience in farming. This variable, as should be expected, is inversely related to risk aversion but on a relatively small scale.

Finally, wealth —measured in terms of the market value of the whole farm— presents a significant effect which is also in the right direction. In order to obtain a model free of the simultaneous equation bias a two-stage least squares model was specified. The results for the TSLS model (Table 4) are very similar to the OLS results. The sign and magnitude of the coefficients remain virtually unchanged with the exception of income and level of technology which now have different signs but with standard errors several times the size of the coefficients. In terms of significance the TSLS results present relatively larger standard errors than the OLS estimates. These results, however, are expected to provide for gains in consistency.

Relevance to Farming Decisions

An important element which cannot be overlooked is the extent to which risk coefficient influences farming decisions. A first step, before the coefficient is actually inserted into the risk programming model, is to look at the relationship that may exist between the risk aversion coefficient and subjective yield prediction. Presumably, farmers who are consistently right about their subjective estimates of yields should show less aversion to risk than farmers who are consistently wrong. If this relation holds empirically, then it is safe to assume that farmers are influenced by their aversion to risk since personal yield prediction is of obvious importance for farm planning.

The farmers interviewed at the time of the elicitation of the risk coefficient were also asked about their subjective distribution of their crop yields and prices[1]. Using the subjective mean yield figure for beans a T value was obtained by comparing them with the actual yields obtained at harvest:

$$T = \frac{\text{Subjective Yields - Actual Yields}}{\text{Standard Deviation of Subjective Yields}}$$

Farmers who showed good ability to predict their bean yields —and thus make their plans accordingly— would have lower T values than farmers whose actual yields fell toward the tail of their subjective distribution.

The results are encouraging (Table 5) as they indicate that the above hypothesis seems to hold. The level of significance for the regression of risk

1/ The methods and results of subjective distributions will be treated elsewhere in order to maintain the unity of the paper.

aversion on the T values is close to ten percent. Given the heuristic nature of the data collection process these results may be considered good.

Policy Implication and Conclusions

Given the relatively good statistical results the implications for farm policy are straightforward. If policy makers are intent on easing off the amount of risk faced by the farmers then the policy instrument should be aimed toward those variables who move in opposite direction to risk aversion such as Level of Technology or Farming Experience. Variables such as Wealth and Income, however, need to be reexamined as their non significance may have something to do with the difficulties in their estimation as well as problem of colinearity with other variables. Research on risk aversion elicitation methods is costly and time consuming. Given the experience accumulated in Southern Huila it is suggested that future empirical research on risk aversion elicitation methods include safeguards against inconsistencies or interview bias in order to obtain a larger amount of useful results from the sample.

Table 1. Distribution of Socioeconomic Characteristics for all Farmers Interviewed

Variable	N	Mean	Standard Deviation	Coefficient of Variation
Age	30	41.96	12.14	28.94
Education	30	2.93	2.58	88.14
Children	30	4.00	2.82	70.71
Adults	30	2.86	2.04	71.39
Off/Farm Work	30	5.25	12.37	235.50
Farm Size	30	7.30	6.56	89.96
Wealth	30	708600.00	654040.10	92.30
Experience	30	14.53	10.06	69.27
Gambling	30	132.66	379.81	286.29
Income	30	88010	76836	87.30

Table 2. Risk Coefficients for Small Farmers in Southern Huila

Type of Gamble [a]	n	$\bar{X}$	s^2	Coefficient of Variation
Consistent farmers[b]				
Coin game	18	-0.30	0.84	-272.53
Subsistence at risk	17	-0.49	0.59	-120.14
Subsistence assured	17	-0.05	0.51	-881.25
All farmers[c]				
Coin game	30	-0.32	0.76	-233.83
Subsistence at risk	29	-0.32	0.54	-167.35
Subsistence assured	29	-0.44	0.68	-155.25

a/ For a detailed explanation of each gamble see appendix.

b/ The coefficients for subsistence at risk and subsistence assured are significantly different at the 0.001 level.

c/ The three coefficients are not significantly different from each other.

Table 3. OLS Regression of Socioeconomic Characteristics on Risk Aversion by Procurement Method

Farmers with Consistent Risk Coefficients

Independent Variable	Coins Game	Risk Aversion with Subsistence at Risk	Risk Aversion with Subsistence Assured
Intercept	-2.401 (1.756)[a]	0.432 (0.914)	1.258** (0.480)
Age	0.036 (0.038)	-0.036 (0.021)	-0.033*** (0.011)
Education	0.055 (0.107)	-0.166*** (0.052)	-0.194*** (0.027)
Crop Tenure Dummy (1=shared crop ownership)	-0.144 (0.495)	-0.738*** (0.236)	-0.784*** (0.124)
Farming Experience	0.021 (0.025)	0.039** (0.014)	0.027*** (0.007)
Level of Technology Dummy (1=uses new inputs)	1.598** (0.595)	0.517* (0.283)	0.494*** (0.149)
Wealth	$-0.68(10^{-6})$ $\{0.41(10^{-6})\}$	$0.48(10^{-6})$** $\{0.20(10^{-6})\}$	$0.34(10^{-6})$*** $\{0.11(10^{-6})\}$
Income	$-4.62(10^{-6})$* $\{(2.5\ (10^{-6})\}$	$-0.75(10^{-6})$ $\{(1.29(10^{-6})\}$	$-1.78(10^{-6})$** $\{(0.68(10^{-6})\}$
F	1.32	4.34	14.37
R^2	0.48	0.77	0.91
MSE	0.62	0.34	0.04
n	17	16	16

a/ Numbers in parentheses are standard errors.

* Significance ≥ 0.1 probability level.

** Significance ≥ 0.05 probability level.

*** Significance ≥ 0.01 probability level.

Table 4. Two-Stage Least Squares Regression of Socioeconomic Characteristics on Risk Aversion when Subsistence is assured for Farmers with Consistent Risk Coefficients

Independent Variable	Income	LevTech	Risk Aversion with Subsistence Assured
Intercept	18150.7 (117017.0)	1.610 (0.946)	2.197 (2.282)
Age	1751.0 (3370.0)	-0.020 (0.03)	-0.049 (0.042)
Education	-1614.0 (8362.0)	-0.065 (0.067)	-0.218 (0.073)
Crop Tenure Dummy (1 = Shared Crop Ownership)	-7689.0 (34873.0	0.046 (0.281)	-0.760 (0.225)
Farming Experience	-1131.0 (2209.0)	-0.008 (0.017)	0.025 (0.012)
Level of Technology Dummy (1 = uses new inputs)			-0.056 (1.295)
Number of children	-10803.0 (7928.0)	-0.050 (0.064)	
Farm Size	9636.0 (2069.0)	0.012 (0.016)	
Wealth	0.03 (0.03)	$0.45(10^{-6})$ $\{0.24(10^{-6})\}$	$0.54(10^{-6})$ $\{(0.46(10^{-6})\}$
Income			$1.32(10^{-6})$ $\{2.32(10^{-6})\}$
F	4.36	1.47	
R^2	0.77	0.53	
MSE			0.10
n	16	16	16

a/ Number in parentheses are standard errors.

Table 5. OLS Regressions of Risk Aversion on Predictive Ability for Yields.

Independent Variable	Prediction Index
Intercept	-0.608 (0.553)[a]
Risk Coefficient (subsistence Assured)	2.363 (1.378)[b]
R^2	0.22
n	11

a/ Numbers in parentheses are standard errors.

b/ Significant at the 0.11 probability level.

APPENDIX

I The Coin Game

Q. What would you prefer:

a) a fixed and certain income of 3.75 pesos

b) a bet, to be decided by a coin toss, which gives you 7 pesos if you win the toss or 0.5 pesos if you lose.

If the farmer prefers (a), decrease its value in sucession until he becomes indifferent between (a) and (b).

The derivation of the risk coefficient is as follows:

Assuming the *utility of income is represented by*

$$U(X) = E(X) + \phi V$$

where X is a risky alternative with an expected value of E(X), a deviation V and a risk coefficient ϕ, then indifference between two income alternatives (a) and (b) implies that

$$U(A) = U(B)$$

Let

$$U(A) = E(a) + \phi V$$
$$U(A) = 3.75 + \phi 0$$
$$U(A) = 3.75$$

and

$$U(B) = E(b) + \phi V$$
$$U(B) = 0.5(7) + 0.5(0.5) + \phi\{0.5[E(b) - 7]^2 + 0.5[E(b) - 0.5)^2]\}^{1/2}$$
$$U(B) = 3.75 + \phi(3.25)$$

Then, if a certainty income is chosen as indifferent to U(B) the risk coefficient ϕ can be calculated from the equation putting U(A) = U(B)

$$U(A) = 3.75 + \phi(3.25)$$

or

$$3.75 = 3.75 + \phi(3.25)$$
$$\phi = 0$$

This farmer is indifferent to risk.

II The Game of Subsistence at Risk

Q. What would you prefer:

a) a property which gives you a certain and fixed income of Y_F per month

b) a property which 3 out of 4 years gives you an income of Y_1 per month and 1 out of 4 years gives you an income of Y_2 per month

In this game the income alternatives (a) and (b) vary according to the income needs of the farmer being interviewed. This way it is asured that a closer real world situation is being considered. Again U(A) is the amount being used as measuring rule, thus being the "fixed income"

III The Game of Subsistence Asured

Q. What would you prefer:

a) a property which guarantees you your family's sustenance plus a certain and fixed income of Y_F per month

b) a property which guarantees you your family's sustenance but gives you an income of Y_1 per month 3 out of 4 years and Y_2 per month 1 out of 4 years.

This game guarantees the farmer food and shelter for him and his family. The risk involves only income needed for expenditures other than food and shelter. In this case the income alternatives are:

$$U(A) = S + Y_F$$

$$U(B) = 0.75(S+Y_1)+0.25(S+Y_2)+\phi\{0.75\left[E(b)-S-Y_1\right]^2+0.25\left[E(b)-S-Y_2\right]^2\}^{1/2}$$

Table A.1. Distribution of Socioeconomic Characteristics for Farmers with Consistent Risk Coefficients

Variable	N	Mean	Standard Deviation	Coefficient of Variation
Age	18	45.16	11.49	25.44
Education	18	2.33	2.72	116.67
Children	18	4.72	3.08	65.29
Adults	18	3.16	2.14	67.85
Off/Farm Work	18	0.44	1.88	424.26
Farm Size	18	7.22	7.46	103.31
Wealth	18	777500.00	632132.82	81.30
Experience	18	17.33	10.83	62.48
Gambling	18	177.77	471.08	264.98
Income	18	100079	89136	89.06