Cuadernos de Economía. Vol. 27, 217-240, 2004

Risk attitudes and the family environment: Application to the firm-households in the olive-oil sector*

Francisca Jiménez-Jiménez**
Departamento de Economía,
Universidad de Jaén y centrA

Resumen

Este trabajo investiga si el entorno socio-cultural de una familia agrícola influye en la actitud hacia el riesgo de sus integrantes. La evidencia sugiere que los agricultores se comportan de forma adversa hacia el riesgo pero, ¿por qué esperar que sus hijos sean diferentes del resto? En este sentido, se comparan las preferencias hacia el riesgo de dos grupos diferentes pero comparables: (i) hijos de agricultores con una larga tradición en la producción de aceite de oliva y (ii) hijos pertenecientes a familias urbanas. Los resultados no parecen indicar diferencias significativas entre ambos grupos, lo que cuestiona que existan actitudes frente al riesgo específicas del entorno agrícola. No obstante, ambos colectivos se muestran adversos hacia el riesgo y poco heterogéneos. Este resultado es consistente con los trabajos experimentales

* The author wishes to thank Pablo Brañas Garza, Gerardo Sabater Grande, Aurora García Gallego, Virtudes Alba Fernández and Javier Rodero Cosano for their helpful comments on an earlier draft of this paper. She gratefully acknowledges financial support from University of Jaén and Jaén Caja Rural research project (#20210/148).

** Corresponding author: Área de Fundamentos del Análisis Económico, Departamento de Economía, Paraje Las Lagunillas s/n, 23071 Jaén (Spain); email: jimenezf@ujaen.es; phone: 00-34-953-212074; fax: 00-34-953-212222.

basados en juegos con premios monetarios pequeños.

Palabras clave: Aversión hacia el riesgo, Loterías, Economía Experimental, Entorno familiar agrícola.

ABSTRACT

This research involves in finding out whether the socio-cultural environment of an agricultural family could influence on the attitudes towards risk of their members. Considerable evidence suggests that farmers behave in risk-averse ways but, why should we expect their children to be much different from the rest of population? We elicit and compare the risk preferences between two different but comparable groups: (i) children of producers with a long field experience on olive-oil farm and, (ii) subjects from urban backgrounds. Our results seem to indicate the no existence of any significant differences between them. Therefore, we could question the prevalence of farming environment-specific risk attitudes. However, both collectives show a considerable risk aversion and low heterogeneity. This is consistent to previous experimental findings related to small-gain gambles.

Keywords: Risk aversion, lotteries, experimental economics, agricultural family environment

JEL Classification: C91, D81, Q12.

1. INTRODUCTION

Analysis of decision making under risk commonly distinguishes many factors that determine the risk preferences. Tversky and Kahneman (1981) and Kahneman and Tversky (1984) are just two examples of the many studies in which these authors emphasise the influence of the cognitive and psychophysical factors. In this sense, personal attributes have been found to play an important role, like age, gender, education level, experience or decision-maker environment (see Ramaratnam et al., 1986; Binswanger, 1980; Barsky et al., 1997; Cooper et al., 1999; etc). In addition, there exist psychological factors which are specific to the choice setting and turn out to be relevant in risky choices. That is the case of the framing effects, the reference-point dependence, the scale effects, the use of hypothetical/real outcomes, etc (see Kahneman and Tversky, 1979; Bosch-Domènech and Silvestre, 1999; Thaler, 1999; Holt and Laury, 2002; among others).

This research involves in finding out whether the family values in which an individual has been brought up influences on her attitudes towards risk. It is therefore very important the selection of the family environments that will be compared. Concretely, we choose two very different contexts: the first, an agricultural family whose day-to-day life depends on very risky situations and with a lot of experience in taking risks and, the second, a family from urban backgrounds who are not related to such risky environment (the industry sector or the public service sector).

In our investigation, as a farming environment we select the agricultural household who produces olive-oil in the south of Spain[1]. The selected family has a long farming experience, it is partner in a cooperative, it is located in a rural area and its agricultural yields represent a high percentage in their family income. A firm-household differs from most kinds of firms because it generally involves all their members in the production activities, especially in small farms where the diversification of the family income is lower. In the olive-oil sector, most of the producers are small farmers. The production of olives is generally a «family business» in which all members of the family participate actively in the farming tasks.

Agricultural production is generally a risky process and extensive evidence exists to suggest that farmers behave in risk-averse ways (see Moscardi and Janvry, 1977; Dillon and Scandizzo, 1978; Binswanger, 1980; Ramaratnam et al., 1986 for some examples). The need for studying the risk attitudes in agricultural settings and its applications in econometric and theoretical models are further documented by Hazell (1982).

The widespread evidence on the producers' risk aversion contrasts with the little literature (or none) related to test whether such a risk-averse behaviour is significantly different. That is, why should we expect producers to be much different? We could think that individuals who make frequently decisions in a risky environment, and consequently have gained field experience operating under uncertain conditions, could have developed skills to mitigate risk. In fact, there exist empirical studies confirming this last hypothesis in the agricultural context. Ramaratnam et al. (1986) find that Texas Coastal Bend farmers with more experience in farming are less risk averse than those with fewer years of farming experience. A similar result was reported by Halter and Mason (1978). Moreover, if farmers have access to risk-sharing insti-

[1] Concretely, in Jaén. This southerly province is the greatest olive-oil producer of Spain. Its production level represents nearly 60% of the national olive-oil production.

tutions, such as the olive-oil cooperatives[2] in our case, then their risk preferences could be compensated.

However, our interest is not in estimating the risk attitudes of the olive-oil farmers, but those of their children to check whether their field knowledge could determine specific risk aversion, acquired from their family environment. Some evidence seems to highlight that olive-oil producers are risk averse and show a reluctance to take risky investments. Although, these studies are not focused on measuring risk attitudes, rather they are general interviews (Barranco et al., 1999).

Up to now, there is no evidence to suggest that the agricultural context induces specific risk preferences. So, this study is focused on a comparative analysis of the risk attitudes to find out whether the children in the farming environment could be more or less risk averse than those in the non-farming one.

In this study, the basic approach is experimental. In normative studies, it is generally assumed that individuals have specific utility functions in income space to estimate the theoretical risk measures (the direct elicitation of utility method). However, these studies have been criticised by their absence of realism in game setting, interviewer bias and lack of time and experience of the participants to become familiar with the hypothetical choices (Binswanger, 1980; King and Robison, 1981).

In this respect, the experimental approach overcomes most of these limitations. It measures attitudes by observing the reactions of individuals to a set of real-payoff gambles. Since our main aim is to compare the behaviour under risk between two different groups and explain the possible differences in terms of the family environment effect, the control of external variables is especially required here. This is the reason why we recruit persons with similar personal attributes: level of education, age, prior experience in laboratory tasks. Moreover, the experimental methodology offers the control of variables that could affect laboratory decisions, such as the payoff scale, the probabilities of success/failure, the framing of the instructions, hypothetical/real payoffs... So, in our design all these factors were the same in both groups, except for the family environment (the treatment variable) in which the subject has been brought up (and obviously the inherent personal characteristics of each person).

[2] An olive-oil cooperative is a business run by the olive producers, who share its profits. This organisation produces the oil and sells it in the market. The cooperatives offer to the producers an insurance mechanism against unpleasant events, such as the olive-oil price fluctuations, climatic conditions, bargaining power in the distribution sector....

Summarising, the aim of this paper is twofold: 1) to test whether the farm-household environment involves a specific behaviour in the risky decision-making and 2) to test whether there exists heterogeneity in the risk attitudes.

In order to achieve these aims, we structure this paper as follows: section 2 describes the experimental design. The procedures are described in the third. Section 4 analyses the data. Section 5 discusses some methodological issues and, finally, section 6 concludes.

2. The experimental methodology

Among the several approaches available for studying attitudes towards risk, the experimental method based on gambling decisions has been chosen in this research to elicit risk preferences. In the agricultural research, this procedure was previously used by Binswanger (1980) with a sample of Indian farmers. However, in the experimental literature many studies have been undertaken over the years to deal with subjects' attitudes towards risk, using different techniques: the lottery-choice method, the willingness-to-pay (WTP) or willingness-to-accept (WTA) elicitation. The WTP/WTA procedures have been criticised as being subject to bias arising from the BDM incentive method used to elicit the true preferences (Isaac and James, 2000). So, in this paper we implement a lottery-choice method. This procedure requires generally the decision-maker to choose among a set of prospects and to receive real monetary incentives according to her behaviour: Murninghan et al. (1988) ask individuals to choose between a two-outcome risky option and a sure payoff; Holt and Laury (2002) and Laury and Holt (2000) offer subjects to evaluate two risky alternatives, one riskier than the other; Sabater-Grande and Georgantzís (2002) follow a different design. They classify subjects according to their choice among a set of lotteries ranked from less risky to more risky ones, including a certain payoff. Bosch-Domènech and Silvestre (1999) ask subjects to choose between playing a gamble (with a 20% chance of losing an amount of money) and buying an actuarially fair insurance against this loss.

In this experiment, following the Murninghan et al. (1988) technique, we design a menu of paired alternatives asking individuals to make ten decisions. The characteristics of the options are the following:

i. Each decision consists of choosing between a safe alternative *A* and a risky lottery *B* of the following form: $[B_1, p; B_2\ 1\text{-}p]$ where $B_1 > A > B_2 > 0$ and *p* is the probability of obtaining the highest outcome.

ii. For each pair of alternatives, the difference of the expected values is given by $D = A - EV(B) = A - [p\ B_1 + (1\text{-}p)B_2]$. Out of the ten decisions, we fix the values of A, B_1 and B_2 so that this difference depends only on the chance of winning the payoff.
iii. The probability p increases from the first decision to the last one in such a way that the sign of the difference of the expected values changes from positive to negative in the sixth choice. Therefore, under the traditional expected utility theory, a risk neutral person will choose the option *A* if this difference is positive and the option *B* if it is negative. That is, the prediction for the neutral behaviour pattern will be the following: *AAAAA/BBBBB*. Likewise, a risk-seeking person will select the safe option A less than five times, whereas a risk averse person will choose it more than five.
iv. The variance of the risky prospect *B* is given by $V(B) = p(1\text{-}p)(B_1\text{-}B_2)^2$. Since B_1 and B_2 are constant, the variance is also a function of the probability of getting the highest payoff, p. This variable reaches its maximum for $p=1/2$, that is, at the fifth decision.

This design is a slightly modified version of the approach used by Holt and Laury (2002). Its major advantage is that all the participants have the same available ten points in the utility/income space for the risky alternative, with what they compare the riskless option *A*. Depending on the curvature of their utility function, the sure income could be worth more or it could be worth less. Therefore, subjects have to identify the probability for the best outcome that would yield a higher utility than the sure amount of money. This probability will determine the crossover point from the sure utility (option *A*) to the expected one (option *B*).

Another advantage is the simplicity. All participants understood the instructions at the first attempt. Since there are only three monetary outcomes to compare, the selection of the probability mix is easier. Recently, Sonsino et al. (2002) present evidence suggesting that the complexity of a given lottery increases the noise in the choice process and reduce the chances that it will be selected. Moreover, our participants are university students, who are sufficiently well educated for the correct interpretation of the odds.

As we noted above, most of empirical work focused on measuring risk attitudes involve in assuming that individuals have a particular utility function. The selection of appropriate funcional forms becomes an important issue since the numerical measures of the degree of risk aversion depends on that. Several functional forms have been used by researchers over the years to represent the producers' utility. Ramaratnam et

al. (1986) estimate four alternative functional forms (quadratic, log-linear, semi-log form and exponential) by a direct elicitation of utility method. They offer producers a series of hypothetical games with equally likely outcomes (50-50). Their results suggest that the exponential form best describes the money utility of the Texas Coastal Bend farmers. However, more recent studies show that individuals do not seem to behave with constant absolute risk aversion, like the exponential function implies. A more suitable hypothesis seems to be considering a decreasing absolute risk aversion utility function (Bosch-Domènech and Silvestre, 1999; Holt and Laury, 2002).

It is important to point out that it is not proposed here to *measure* the individual attitudes towards risk or to judge the merits of the hypothesis of decreasing absolute risk aversion. Rather, emphasis is directed towards comparing the behaviour under risk between two different environments. Therefore, the theoretical background underlying to our design is only useful to *characterise* the risk attitudes of our respondents and to compare them with those of other experimental studies which employ a similar risk measure.

Consequently, we characterise the individual choice by a constant relative risk aversion (CRRA hereafter) coefficient. This is the most common theoretical risk measure in the experimental studies (see Binswanger, 1980; Goeree et al., 1999; Goeree and Holt, 2004; Holt and Laury, 2002; etc).

In order to avoid the bias arising from choosing a functional form *a priori*, we consider a general functional form, like this:

$$u(x) = \begin{cases} \dfrac{x^{1-r}}{1-r} & \text{if } r \neq 1 \\ \ln r & \text{if } r = 1 \end{cases} \qquad (1)$$

where x is the monetary outcome and $r = -xu''/u'$ is the relative risk aversion coefficient. This is the utility function assumed by Holt and Laury (2002) and implies constant relative risk aversion (CRRA). Note that it is very similar to that proposed by Kahneman and Tversky (1979) in their prospect theory on the gains domain.

In our design, if the individual is indifferent between both alternatives, we have that $U(A) = EU(B)$. Hence,

$$A^{1-r} = pB_1^{1-r} + (1-p)\, B_2^{1-r} \qquad (2)$$

For given values of p, A and B, this condition allows us to estimate the respondents' degree of relative risk aversion, the coefficient r. Note that $r = 0$ implies that

the utility is proportional to income, that is, the individual is risk neutral. Since the marginal utility is given by x^{-r}, this is decreasing in income if $r > 0$ and, then, the individual shows risk aversion. In contrast, for $r < 0$, the marginal utility is increasing in income and the individual is risk loving.

The payoff numbers A, B_1 and B_2 are selected to make the risk neutral choice pattern (AAAAA/BBBBB) optimal for a CRRA coefficient belonging to the symmetric around zero interval (-0.4, 0.4) and, simultaneously, to achieve a «realistic» proportion among the three outcomes[3]. As we pointed, for each number of choices A we get an interval estimation of the CRRA coefficient, assuming the utility function (1). King and Robison (1981) present a method for interval measurements for decision makers' absolute risk aversion functions. They demonstrate that the interval approach allows explicit consideration accuracy and discriminatory power of preferences measurements.

Table 1 summarises all this information.

Table 1. Characterisation of the options set

Experimental Design							
Option A	Option B	EV(B)	A-EV(B)	V(B)	Number of Options A chosen	CRRA coefficient estimates	Classification of risk attitudes
283	[400,1/10;140,9/10]	166	117	6084	1–0	r<–3.55	Risk Loving
283	[400,2/10; 140,8/10]	192	91	10816	2	–3.55<r<–2.27	
283	[400,3/10; 140,7/10]	218	65	14196	3	–2.27<r<–1.28	
283	[400,4/10; 140,6/10]	244	39	16224	4	–1.28<r<–0.4	
283	[400,5/10; 140,5/10]	270	13	16900	5	–0.4<r<0.4	Risk Neutral
283	[400,6/10; 140,4/10]	296	–13	16224	6	0.4<r<1.25	Risk Averse
283	[400,7/10; 140,3/10]	322	–39	14196	7	1.25<r<2.25	
283	[400,8/10; 140,2/10]	348	–65	10816	8	2.25<r<3.64	
283	[400,9/10; 140,1/10]	374	–91	6084	9–10	r>3.64	
283	[400,10/10; 140,0/10]	400	–117	0			

[3] The selected stakes correspond approximately to the real prices observed in the olive-oil market: A=283 ptas/kg was the olive-oil price at the moment of the experiment; B_1=400 ptas/kg has been the approximate price in years where the crop has been very good and B_2 =140 when this crop has been bad.

3. THE EXPERIMENTAL PROCEDURES

Since we wished to test the existence of risk attitudes which were specific of the family environment, we recruited people who belonged to two extreme household-types. The collective I (called farm-household treatment) consisted of sons/daughters of olive-oil producers with a long farming experience, they were partners in a cooperative, they were located in a rural area and their yields from the sector represented a high percentage in their household income. In the recruiting process they were asked to fill in a questionnaire (see appendix 3) to ensure ourselves that these individuals participated actively in the farming tasks and knew the production characteristics. The collective II (called non-farm household treatment) were sons/daughters of parents without any relationship with this sector, located in the urban area and their resources came from no-agricultural sectors[4].

There are many reasons why one may question whether an individual is able to regard her personal environment in a laboratory setting. Therefore, we used an «olive-oil context» to describe the alternatives that each subject should evaluate and choose according to her preferences. The instructions were exactly the same for the two groups (see appendix A.1[5]). They simulate a series of decisions about the allocation of olive-oil harvest between two cooperatives (A or B) that differ in their payoffs conditions (see appendix A.2). The cooperative A pays a sure amount of money, whereas the cooperative B offers risky conditions, according to the characteristics of the design.

Context can be expected to play an important role in triggering the connection between our laboratory gambling decision and the field experience of the farming subjects. In this way, we believe that the farming subjects should be concerned about what they were being asked. Godden and Baddeley (1975) find experimental evidence involving that even when context is not directly relevant to what is being done, it can serve as a trigger for recall. More recently, studies confirm that meaningful context can affect subjects' behaviour (see Cooper et al., 1999 and Cooper and Kagel, 2003).

Our stakes were large in comparison to the payment for one hour of work. So, we were confident that the subjects took the task seriously. The sure prize was 1698 ptas

[4] They were families where only the householder (or both parents) worked and the children only studied.

[5] They are a translation to English. They were written and explained in Spanish.

(about 10 dollars) and the lottery's payoffs 2400 ptas (about 14 dollars) or 840 ptas (about 5 dollars)[6].

As we explained in the earlier section, in the first decision the probability of getting the high payoff in the lottery B is 1/10 and moving down along the table this probability increases up to 1. Therefore, only an extreme risk seeker would accept the cooperative firm B in the first decision. In the same way, only a terribly absentminded person would choose the riskless cooperative A in the last decision (probably by some noise). Except for these extreme behaviours, a subject should cross over from option A to B when the probability of the high payoff increases. So, we take «the number of times that an individual chooses the cooperative A in the ten decisions» as our instrumental variable to characterise the individual risk preferences and to determine the interval estimation of the CRRA coefficient according to the table 1.

At the end of the experimental session, the final monetary outcomes were determined individually using a random lottery incentive system[7]. Even though each individual made ten decisions, only one was chosen to calculate the earnings which she took home. We used a ten-sided die and the selection was undertaken individually when each participant finished her tasks. If in the selected decision the subject had chosen the risky alternative, the die was thrown again to determine the final earnings. Therefore, all subjects were paid in cash (Spanish pesetas) according to their performance and the outcome of the chosen option.

Overall, the average time spent in running each session was about 20 minutes and earnings averaged about 1800 Spanish Pesetas (approximately, $11, $33 an hour) for both treatments. Therefore, our experiment was worth participating in for the subjects. The difference between the highest and the lowest outcome of the lottery, compared with the sure outcome, made it interesting to choose the crossover point.

The participants were undergraduate students at the University of Jaén. The experiment was run by 121 students, 61 of which were from farming families and the rest 60 from the non-farming households. The recruitment process was done throughout two independent calls by using advertisements around the university. We formed groups of 15-20 participants per session.

[6] To determine the final payoffs, we used the prices from the table 1 multiplied by 6, unknown for the participants.

[7] Cubitt el al. (1998) report evidence on the validity of this method to motivate subjects.

4. RESULTS

4.1. *Risk aversion: are really the farm-households more risk averse?*

Table 2 presents a simple descriptive analysis from the experiment in terms of the distribution of attitudes towards risk for each sample.

Table 2. Distribution of individuals by treatment

Number of Safe Choices	Number of subjects		Classification
	Farming Household Treatment	Non-farming Household Treatment	
1	0	0	Risk Loving
2	0	1	
3	1	1	
4	8	9	
5	12	10	Risk Neutral
6	17	18	
7	12	12	
8	6	6	Risk Averse
9	4	3	
10	1	0	
Total Observations	61	60	
Aver. Safe Choices	6.15	5.97	
St. Dev.	1.51	1.49	

These results indicate that the majority of participants show risk aversion according to our classification. Approximately two thirds of subjects choose more than five times the A option in both groups. Furthermore, at the fifth decision, the proportion of individuals who prefer to insure themselves (choosing the A option) reaches 85% in the farming treatment (those who are not risk loving, that is, (61-9)/61) and 81% in the non-farming treatment (that is, (60-11)/60).

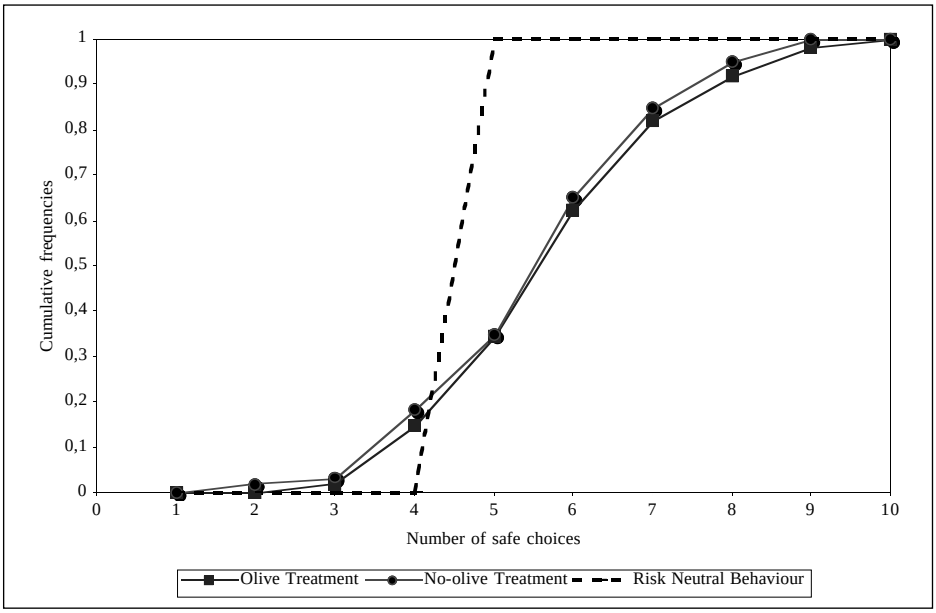
As we expected, risk aversion is the predominant behaviour in the farm-household group. However, it is also in the second one. The most preferred pattern corresponds to six safe decisions, which represents 28% (17/61) and 30% (18/60) of the population in the farming and in the non-farming treatments, respectively.

Outcome 1: *A clear majority of the individuals who participate actively in the farming tasks show a considerable risk aversion.*

Note that in the farming treatment there was one person who chose ten times the cooperative A. Clearly, such behaviour is not rational in an economic sense.

Remember that our main objective is to test whether participating in the farming environment implies a greater risk aversion. So, a comparative study indicates that there are not any significant differences between the subjects who have been brought up in a farming family and the participants from urban backgrounds, in terms of the average degree of risk aversion[8]. Figure 1 plots the distribution of cumulative frequencies for the safe choices over both treatments.

Figure 1. Distribution of cumulative frequencies by treatments.
(Predictions of risk neutral behaviour in dashed line)



Clearly, if all individuals were risk neutral, the cumulative probability would be zero for four or fewer safe choices and would increase suddenly up to one at five safe choices (see the dashed line). The line with dots provides the behaviour for non-farm households whereas the line with squares reflects the responses for the farm-house-

[8] Applying a t-Student Test for the homogeneity of averages for both treatments, we accept the null hypothesis at p = 0.05. The confidence interval is (-0.36, 0.73) at a 95% significance level.

holds. Note that both lines are difficult to distinguish. Moreover, there exists a notable tendency towards risk aversion in both groups, comparing them with the neutral predictions. In addition, as we can see in the earlier table 2, there are more people choosing risk loving categories in the non-farm treatment than in the other one, although the differences are nearly unappreciate.

With all, we can conclude that the olive-oil environment has not any statistically significant effect on the individual risk attitudes in our experiment. Then, our results seem to reject the existence of prevalent environment-specific attitudes towards risk.

Note that even though we selected two very extreme environments and used «specific framing», we have not found any evidence that the agricultural environment implies more risk aversion than in other settings.

Outcome 2: *Subjects, who are sons/daughters of olive-oil producers and participate actively in the farming activities, are not particularly more risk averse than the subjects from urban backgrounds.*

The next comparison is between our results and those of other studies. In absolute terms, our average number of safe choices is very similar to that obtained by Holt and Laury (2002) in their low real payoffs treatment (5.2). Since they designed the paired lotteries in such a way that the risk neutral pattern was four times choosing the less risky option, an average of 5 in their design would correspond with an average of 6 here. In fact, the individuals who belong to the olive-oil sector have 6.15 as average and the members of non-farm households have 5.97.

In relative terms, the six safe choices pattern observed in our experiment is characterised by an estimation of the CRRA coefficient $0.4 < r < 1.25$ (see table 1). Some prior estimates for relative risk aversion are the following: above 0.32 for the farmers in Rural India using a lottery-choice experiment (Binswanger, 1980); 0.52 in private-value auctions (Goeree et al., 1999); 0.45 in one-shot matrix games (Goeree and Holt, 2004); 0.44 in asymmetric matching pennies games (Goeree et al., 2002); 0.3-0.5 range in lotteries choices (Holt and Laury, 2002). Notice that all these estimates are consistent with our findings. Therefore, not only our groups show similar risk attitudes between themselves, but they are similar to those shown in other studies.

Lastly, we explore the variation level in the risk preferences. If we observe the safe choices distribution in table 2, we realise that the degree of heterogeneity is very low in both treatments. Data is concentrated in 5-6 number of safe choices. Moreover, the standard deviations are 1.53 in the farm-household group and 1.51 in the non-farm one.

The low heterogeneity in subjects' risk attitudes found in our experiment strongly supports the earlier literature. Holt and Laury (2002) find standard deviations from 1.4 to 1.8 using a similar design. In the agricultural literature, our results are also consistent with those of Ramaratnam et al. (1986) for the assumed exponential utility function and Binswanger (1980) who estimates a relative risk aversion coefficient. However, in studies which employ quadratic forms conclude that there are equal numbers of risk averse, risk neutral and risk preferring producers (e. g. Halter and Mason, 1978).

Outcome 3: *There exists a low heterogeneity in the attitudes towards risk in both household samples. Observations are concentrated in the risk aversion.*

4.2. *Further characterisation of risk aversion*

Remember that in the recruiting process we distributed a questionnaire only to the members of farm-households (see appendix A.3) to collect information about production and demographic characteristics. All of them participate in the farming tasks and their parents are partners in a cooperative. Additional variables measuring the context are the following: parent occupation, olive production level in the parent farm, proportion of the olive harvest delivered to the olive-oil cooperative and farm income dependency. In addition, the gender of the participants in the experiment (farming and non-farming) was noted.

We are concerned about the risk attitudes would be different between an olive producer and his/her children. A student has normally no family to provide for, no big liabilities and no business that has to be profitable, in contrast to an olive farmer. However, our interest is not focused on approximating the producers' risk attitudes through their children's risk attitudes. Provided that in the farming environment our subjects have shown risk aversion, it would be desirable if individual differences in risk attitudes could be related to some context characteristics.

For comparability in the statistical analysis, we divided all observations in three risk categories, according to the number of safe choices is among 0-3, 4-6 and 7-10. We have tested independence between risk attitudes classification and context variables in a two-way contingency table with multinomial sampling, applying the Pearson Chi-Squared statistic to the null hypothesis of statistical independence.

Related literature seems to indicate a positive correlation between production level and risk aversion. In our experiment, our findings confirm this relationship. We

find that there exists dependence between risk aversion and production level ($p< 0.01$), in the sense that the children of producers with larger operations are more risk averse than those whose parents obtain lower production.

Since a firm-household differs from most kinds of firms because part of the firm's output is consumed by the family itself, we noted the quantity of olive harvest delivered to the olive-oil cooperative. We find that this variable is not significant to explain the risk aversion in our sample. The reason could be the fact that the most of the producers deliver the whole amount of their harvest to the cooperative, without using alternative insurance mechanisms.

Another surprising result is related to the percentage of income from farming. The farm income dependency do not appear to exhibit relationship with the risk preferences. The children of families with a greater percent of income from farming do not seem to become more risk averse than the students of families with less dependency.

Lastly, we find interesting results related to the variable gender. Recent surveys and experimental evidence show that in financial decision-making women are less-prone than men (see Barsky et al., 1997). Since our purpose was not to contrast this gender effect, our final distribution between men and women did not result uniforme. Although, we have the following pattern: using all observations pooled from both samples (farming and non-farming), the first surprising result is the lack of a significant relationship between sex and risk aversion. However, if we separate by environments we just find a significant dependence in the farming-context ($p = 0.008$). That is, if in our experiment there exists any relationship between risk aversion and gender, this come from the individuals who belong to a farming environment. This means that men exhibit more risk-taking than women.

Table 3 summarises all these relationships.

Table 3. Relationship between risk attitudes and explanatory variables

Variables	Farming Environment	Non-farming environment
Production Level	Dependence ($p =0.0029$)	
Sex	Dependence ($p= 0.008$)	Independence ($p= 0.541$)

5. Discussion

As we have noted, our experimental data show risk aversion if we assume that individuals are expected-utility maximisers. Expected utility theory explains risk aversion solely because the utility function of wealth is concave (diminishing-marginal-utility-of-wealth). However, Rabin (2000) and Rabin and Thaler (2001) have severely criticised the relevance of standard utility theory as basis for risky choice. As Rabin (2000) asserts, this theory implies that people are approximately risk neutral when stakes are small, as often happens in the laboratory. This result was already shown by Arrow (1971).

Rabin presents in his work a calibration theorem that reinforces the inability of the expected utility theory to provide a plausible account of risk aversion over modest stakes. The basic idea is that within the expected-utility framework, turning down a modest-stakes gamble implies unrealistic risk aversion over large stakes. Therefore, he presents the *loss aversion* as a direct explanation for modest-scale risk aversion.

In the recent paper, Rabin and Thaler (2001) call as «anomalies» to two concepts that offer jointly a right explanation for the risk aversion found in laboratory settings: loss aversion and mental accounting.

1. Loss aversion is the tendency to feel the pain of a loss more acutely than the pleasure of an equal-sized gain. This is an important aspect of the Kanheman and Tversky's Prospect Theory, a model alternative to the Expected Utility Theory to explain the decision making under risk. Kahneman and Tversky (1979) propose that individuals evaluate the potential payoffs of the lotteries (gains or losses) relative to a value function with the following characteristics: (i) it is defined on deviations from some reference point ; (ii) it is concave for gains and convex for losses; (iii) it is steeper at each level of loss than at the corresponding level of gain, this is the loss aversion[9].
2. Mental accounting refers to the fact that small-scale risk aversion seems to derive from the tendency to assess risks in isolation rather than in broader perspective (see Thaler, 1999).

[9] Later, Kahneman and Tversky (1992) develop a new version of prospect theory that invokes the diminishing sensitivity and loss aversion to explain the characteristic curvature of the value function and the weighting functions.

The combination of loss aversion and mental accounting is called «myopic loss aversion» by Benartzi and Thaler (1995) to explain the equity premium puzzle. One reason why people behave in a risk-averse manner is that they evaluate risk, presented to them in isolation, separately from other risks they face. These authors assert that if investors focused on the long-term returns of stocks they would recognise how little risk there is and would be happy to hold stocks at a smaller equity premium[10].

Although our experiment doesn't involve any losses, our individuals have behaved as risk averse, in aggregate terms, in the gain domain in both treatments, such as the value function of Kanhemann and Tversky proposes. Clearly, if individuals had taken as a reference point the income level at the beginning of the experiment (the status quo or zero), all monetary payoffs would have been denominated as gains. However, subjects might have taken the safe payoff of the cooperative A (1698 ptas) as their reference point. In this case, this would have supposed to have as potential payoffs of the option B a gain of 702 ptas (2400-1698) or a loss of 858 ptas (840-1698). So, people could have formulated the decision task in terms of taking or not the risk related to the prospect B.

Since the framing of our instructions induces to take the status quo (or zero income) as a reference point, the risk aversion in our experiment is consistent with the concavity of the value function of Kahneman and Tversky (1979) in the domain of gains. However, according to Rabin (2000), the use of small-stakes games should have shown risk neutrality. In fact, we find a very high degree of risk aversion over modest stakes, what would imply an unrealistic risk aversion over large ones. This could mean that some respondents had shown mental accounting in our experiment.

Therefore, due to the presence of possible reference-point effects, we are reluctant to interpret the general tendency to the risk aversion observed in our data solely using expected-utility theory. It is needed to assume that either loss aversion and mental accounting may exist.

[10] This myopic loss aversion would also explain the response of Samuelson' colleague (see Samuelson, 1963).

6. Concluding remarks

The main purpose of this research was to compare the individual attitudes towards risk between two different environments: 1) individuals who have brought up in a farm-household and participate actively in the farming activities of the particular olive-oil sector, and 2) individuals who belong to a household from urban backgrounds, without any relationship with so risky environments. The widespread view concerning the considerable risk aversion observed in this specific environment is confirmed by our data.

The findings reported here question the prevalence of environment-specific risk attitudes. There are not significant differences between both groups. We find that subjects from farm-household do not generally exhibit a more risk averse behaviour than the subjects from non-farming families. In practice, our findings seem to suggest that preconceptions concerning the family environment influences on risk preferences of its members may be more prejudice than fact.

Another important finding is the low heterogeneity in the risk attitudes of our respondents. There are a few of subjects willing to accept risks, most of subjects show risk averse behaviour.

Lastly, a further characterisation of the risky behaviour in the farming group appears to indicate that production level and sex are significantly related to risk preferences. The children of producers with larger operations are more risk averse than those whose parents obtain lower production. Likewise, men exhibit more risk-taking than women.

References

Arrow, K. E. (1971), *Essays in the Theory of Risk-Bearing*, Markham Publishing Company.

Barranco, D.; Fernández-Escobar, R.; Rallo, L. and others (1999), *El Cultivo del Olivo*, Junta de Andalucía y Ediciones Mundi-Prensa.

Barsky, R. B.; Juster, F. T.; Kimball, M. S. and Shapiro, M. D. (1997), «Preference Parameters and Behavioral Heterogeneity: An Exprimental Approach in the Health and Retirement Study», *Quarterly Journal of Economics* 112 (2), 537-579.

Benartzi, S. and Thaler, R. H. (1995), «Myopic Loss Aversion and the Equity Premium Puzzle», *Quarterly Journal of Economics* 110, 73-92.

Binswanger, H. P. (1980), «Attitude toward Risk: Experimental Measurement in Rural India», *American Journal of Agricultural Economics* 62, 395-407.

BOSCH-DOMÈNECH, A. and SILVESTRE, J. (1999), «Does Risk Aversion or Attraction Depend on Income? An Experiment», *Economics Letters* 65 (3), 265-273.

COOPER, D. J.; KAGEL, J. H.; LO, W. and LIANG-GU, Q. (1999), «Gaming against managers in Incentive Systems: Experimental Results with Chinese Students and Chinese Managers», *American Economic Review* 89 (4), 781-804.

COOPER, D. J. and KAGEL, J. H. (2003), «The Impact of Meaningful Context on Strategic Play in Signaling Games», *Journal of Economic Behavior & Organization* 50, 311-337.

CUBITT, R. P.; STARMER, C. and SUGDEN, R. (1998), «On the Validity of the Random Lottery Incentive System», *Experimental Economics* 1, 115-131.

DILLON, J. L. and SCANDIZZO, P. (1978), «Risk Attitudes of Subsistence Farmers in North-East Brazil: A Sampling Approach», *American Journal of Agricultural Economics* 60 (3), 425-435.

GODDEN, D. R. and BADDELEY, A. D. (1975), «Context-Dependent Memory in Two Natural Environments: On Land and under Water», *British Journal of Psychology* 66 (3), 325-331.

GOEREE, J. K. and HOLT, C. A. (2004), «A Model of Noisy Introspection», forthcoming in *Games and Economic Behavior*.

GOEREE, J. K.; HOLT, C. A. and PALFREY, T. R. (1999), «Quantal Response Equilibrium and Overbidding in Private-Value Auctions», Working Paper, California Institute of Technology.

— (2002), «Risk Averse Behavior in Generalized Matching Pennies Games», Working Paper, University of Virginia.

HALTER, A. N. and MASON, R. (1978), «Utility Measurement for Those Who Need to Know», *Western Journal of Agricultural Economics* 3 (1), 99-109.

HAZELL, P. B. (1982), «Application of Risk Preference Estimates in Firm-Household and Agricultural Sector Models», *American Journal of Agricultural Economics* 64 (2), 384-390.

HOLT, C. A. and LAURY, S. K. (2002), «Risk Aversion and Incentive Effects», *American Economic Review*, 1644-1655.

ISAAC, R. M. and JAMES, D. (2000), «Just Who Are You Calling Risk Averse?, *Journal of Risk and Uncertainty* 20 (2), 177-187.

KAHNEMAN, D. and TVERSKY, A. (1979), «Prospect Theory: An Analysis of Decision under Risk», *Econometrica* 47 (2), 263-291.

— (1984), «Choices, Values and Frames», *American Psychologist* 39 (4), 341-350.

KING, R. P. and ROBISON, L. J. (1981), «An Interval Approach to the Measurement of Decision Maker Preference», *American Journal of Agricultural Econonomics* 63 (3), 510-520.

LAURY, S. K. and HOLT, C. A. (2000), «Further reflections on Prospect Theory», Working Paper, University of Virginia.

MOSCARDI, E. and JANVRY, A. (1977), «Attitudes toward Risk among Peasants: An Econometric Approach», *American Journal of Agricultural Econonomics* 69 (4), 710-726.

MURNINGHAN, J. K.; ROTH, A. E. and SCHOUMAKER, F. (1988), «Risk Aversion in Bargaining», *Journal of Risk and Uncertainty* 1, 101-124.

RABIN, M. (2000), «Risk Aversion and Expected-Utility Theory: A Calibration Theorem», *Econometrica* 68 (5), 1281-1292.

RABIN, M. and THALER, R. H. (2001), «Anomalies: Risk Aversion», *Journal of Economic Perspectives* 15 (1), 219-232.

RAMATNAM, S.; RISTER, M. E.; BESSLER, D. A. and NOVAK, J. (1986), «Risk Attitudes and Farm/Producer Attributes: A Case Study of Texas Coastal Bend Grain Sorghum Producers», *Sourhern Journal of Agricultural Economics* December, 85-95.

SABATER GRANDE, G. and GEORGANTZÍS, N. (2002), «Accounting for Risk Aversion in Repeated Prisioners' Dilemma Games: An experimental Test», *Journal of Economic Behavior & Organization* 48 (1), 37-50.

SAMUELSON, P. (1963), «Risk and Uncertainty: A Fallacy of Large Numbers», *Scientia* 98, 108-113.

SONSINO, D.; BENZION, U. and MADOR, G. (2002), «The Complexity Effects on Choice with Uncertainty- Experimental Evidence», *The Economic Journal* 112 (October), 936-965.

THALER, R. H. (1999), «Mental Accounting Matters», *Journal of Behavioral Decision Making* 12, 183-206.

TVERSKY, A. and KAHNEMAN, D. (1981), «The Framing of Decisions and The Psychology of Choice», *Science* 211, 453-458.

— (1992), «Advances in Prospect Theory. Cumulative Representation of Uncertainty», *Journal of Risk and Uncertainty* 5, 297-323.

APPENDIX

A.1. *Instructions*

This is a research in the economics of individual decision making. The instructions are simple and if you follow them carefully, you might earn a considerable amount of money which will be paid to you in cash after the experiment. Your decisions during this session will affect the final payoff that you will receive at the end.

In this experiment you will choose between two cooperatives, A or B, to which you will deliver a quantity of olive-oil. Attached to the instructions you will find an information sheet which shows the different paired alternatives. You will have to make ten decisions and write them in the final column.

Assume that you have a quantity of olive-oil and you can sell it to one of the two cooperatives. The table contained in the decision sheet describes the different monetary outcomes that each cooperative offers. Each row represents a possible scenario. You must choose only one option, A or B, in each situation.

Your final payoffs will be computed as follows: even though you will make ten decisions, only ONE will be used to calculate your final earnings but you will not know in advance which one will be. Each decision has the same chance of being selected. We use a ten-sided die (numbered from 0 to 9) to determine it. If in the selected decision you chose the cooperative A, then you will earn 1698 ptas (Spanish currency) by sure. However, if your choice was the cooperative B we will throw the die again. This second throw will allow us to determine if your final earnings are 2400 or 840 ptas (Spanish currency).

Now, please look at decision 0 in the first row of the information sheet. The cooperative A yields a sure gain of 1698 ptas while the cooperative B offers 2400 ptas if the throw of the ten-sided die is 0 and 840 ptas if the throw is different (1-9). The following decisions are similar. Although, note that as you move down the table, the best outcome of the cooperative B is more likely. So, in the decision 1 the cooperative B pays 2400 ptas if the number of the throw is 0 or 1 and 840 ptas if it is 2-9. In the last decision, you will make the choice between the sure gain 1698 ptas of the cooperative A and the gain 2400 ptas (also by sure) of the cooperative B.

Summarising, you will make ten decisions. Each decision consists of choosing between A or B and write it in the final empty column of the information sheet. At the end, only one out the ten decisions will determine your final earnings.

Lastly, do not forget to write your identification number at the top of the decision sheet. This number is just for data-collecting purposes.

Are there any questions?

A.2. *Decision Sheet*

IDENTIFICATION NUMBER: _____

DECISION	CO-OP. A	CO-OPERATIVE B				YOUR CHOICE (A or B)
	Money Payoff (ptas)	Money Payoff (ptas)	With probability	Money Payoff (ptas)	With probability	
0	1698	2400	1/10	840	9/10	
1	1698	2400	2/10	840	8/10	
2	1698	2400	3/10	840	7/10	
3	1698	2400	4/10	840	6/10	
4	1698	2400	5/10	840	5/10	
5	1698	2400	6/10	840	4/10	
6	1698	2400	7/10	840	3/10	
7	1698	2400	8/10	840	2/10	
8	1698	2400	9/10	840	1/10	
9	1698	2400	10/10	840	0/10	

Total Money Earnings _____ptas

A.3. *Questionnaire*

IDENTIFICATION NUMBER_____

QUESTIONNAIRE

1. Is your family a partner of any olive-oil cooperative? 1- Yes. 2- No.

2. In affirmative case, could you indicate the proportion of the olive harvest that you deliver?
   - ❑ Nothing.
   - ❑ Lower than 25%.
   - ❑ Between 25% and 50%.
   - ❑ Between 50% and 75%.
   - ❑ Between 75% and 100%.
   - ❑ 100%.

3. Do you participate actively in the production tasks of your family business? 1- Yes. 2- No.

4. What is the approximate quantity of olive production obtained in the harvest 2000/2001?
   - ❑ Lower than 10.000 kg.
   - ❑ 10.001 – 50.000 kg.
   - ❑ Greater than 50.000 kg.

5. The agricultural yields that your family get from the olive-oil sector, what sort of income is?
   1- Primary. 2- Secondary.