Inquiring into decision makers' qualities

INQUIRING INTO DECISION MAKERS' QUALITIES

by Luigi Bollani* and Guido A. Rossi *

Abstract. This paper is concerned with empirical experimentation of preferences and attitudes in decision making elicited with regard to the inner self and not only to the outer self. We applied the de Finetti extended decision paradigm introduced by Rossi in 1994. We took into consideration the correspondence between behavioural characteristics of decision makers and formal properties of the paradigm and also some linkage between individual experimental behaviour and lifestyle or personality. The experimental work started in 1996 and it is still in progress.[1]

Keywords: de Finetti's theory, expected utility, rational behaviour, empirical survey.

Foreword. The plan of the paper is as follows. In section 1 we present the goals of our research which couples financial choices and the decision maker's personality. In section 2 we briefly sketch the decision model we use. In section 3 we present the design of our experimentation. In section 4 we present some results and comment them. In the Appendix we include a copy of some sets of lotteries and questionnaire used in the experimentation.

1. Introduction. The aim of this paper lies within the field of empirically testing financial choices. We present several surveys consisting of some set of lotteries to be ordered according to preference. We make reference to the de Finetti extended decision theory as developed in Rossi (1994a). The idea is to suppose that the decisions are taken using the paradigm, and then to estimate its parameters.

The experimental work is based on surveys in which different sets of lotteries are submitted to different groups of people, first pairwise and then all together.[2] We then request to rank lotteries in preference order. Results are obtained by transforming choices into inequalities: their solutions, including the null set, show different types of decision maker’s preferences. The results already achieved show that the model reveals influence of risk attitudes on behaviour quite well. We also show the results obtained by considering some relationships between personal behaviour (in the test) and some lifestyle, personality and social attitudes achieved through questionnaires.

2. The decision model (de Finetti extended). The certainty equivalent with associative and monotonic preferences (using the Nagumo, Kolmogorov, de Finetti Theorem) gives the expected utility in the version of de Finetti extended theory. The formula for evaluating act or prospect j , is (see Rossi 1991, 1994a):

$$u_j = g^{-1}(h^{-1}(\int_{a \in A} h(g(u(a)))dF_{j,U}(a))) \qquad (1)$$

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[1] We presented the results achieved at different times in several international meetings like FUR VIII (Belgium – Mons, 1997), Third International Workshop on Preference and Decision -Trento 2000 (Italy, Trento, 2000), FUR X (Italy - Torino, 2001).

[2] Till now we have chosen groups of students.

where u_j is the preference for act or prospect j ; A is the set of all a, constituents or elementary events including their consequences ; $u(a)$ is a bounded preference function (independent of j because of the fine description required in A) ; g is any strictly increasing and continuous function to account for indeterminacy of preference function (if desired) ; h, strictly increasing, continuous and defined up to a positive affine transform, is the risk attitude function, representing risk attitude in a pure, though not exclusive, way ; $F_{j,U}$ is the cumulative distribution function induced on random variable U (defined on A, assuming values u, in a closed and bounded interval) by the distribution on A caused by act (or prospect) j. We remark that there is no reason why h should not change according to the different evaluations. Thus using the same h in different evaluations is a choice.
Different decision models can be obtained by branching out at same step so to have a rougher scheme.

3. The experimental design. The goal of the empirical analysis is to verify the described paradigm applying it to observed preferences and to use it in inspecting decision makers' qualities. The project leads to examine pairwise choices and complete ranking experiments, with the influence of framing effects on the identification of the functions h and g, and with the importance of identifying different roles and of repeating tests with the same subjects at different epochs.
By now, in the actual experimentation, we consider u as the monetary value of the same object a, calling it x.[3] Variable X is strictly linked with h through g, and we also suppose g constant for each decision maker across all the different choices and h constant across each set of choices on the same set of alternatives proposed to the decision makers. The functions h and g give the unique up to a linear affine transformation[4] $f(\cdot) = h(g(\cdot))$ for each set of binary (or else) choices regarding the same set of alternatives. In this case we can simplify formula (1) as follows (for an easier interpretation the Stieltjes integral is also written as a sum in a finite set) :

$$x_j = f^{-1}\left(\sum_{i=1}^{n} P(a_{i,j}) f(x(a_{i,j}))\right) \qquad (2)$$

where f represents the decision maker's risk attitude completely (it depends both on the context of the decision to be taken and on money evaluation), $a_{i,j}$ is an alternative for act or prospect j and $P(a_{i,j})$ is its probability.
Besides, f is assumed to be a polynomial[5] as in Rossi (1994a), because we consider the moments of each distribution of variable X, which give a good description of the distribution itself. In fact, if f is a polynomial, when we establish a preference between distributions we obtain an inequality (an equation in case of indifference) linear in the coefficients, because the inverse f^{-1} is present on both sides and (being strictly monotonic) can be dropped.
More precisely formula (2) shows that u_j , by exception of the f^{-1} antitransform and thinking f as polynomial, becomes a linear combination of moments around the origin (or, with appropriate transformations, about the mean).

[3] It is done for the sake of simplicity : it can be changed in future works, especially when we shall try to identify different roles
[4] Alternatively one can imagine g to be identity
[5] In some circumstances (not in this work), it may be convenient to impose some properties to the polynomial. For instance, we may desire the polynomial to exhibit some smoothness such as limitations to its total variation, or to the varying of its slope, such as the minimum for some function of second order differences. It is a problem of mathematical programming under linear constraints, studied in Diale (1990)

In our experimentation we assume that the first three moments are sufficient for the description of each variable X (accordingly with the aim of evaluate individual psychological attitudes in choices), and so we consider *f* being a third degree polynomial of the form $f=c_0+c_1X+c_2X^2+c_3X^3$. [6]
Besides, we use its indeterminacy putting the leading coefficient equal to 1 and the constant term equal to 0, applying to each choice the following condition:
act j is (strictly) preferred to act i iff

$$c_1\sum X_j + c_2\sum X_j^2 + \sum X_j^3 > c_1\sum X_i + c_2\sum X_i^2 + \sum X_i^3 \qquad (3)$$

In this way, for each choice it is possible to plot a specific half-plane in R^2. The set of individually acceptable coefficients is the intersection area.[7]
To evaluate in a useful way the characteristics of this area, it is also important to find some reference areas in R^2 directly by imposing some relationships between coefficients.
For instance, if we take *x* in a given interval, say [0 ; 1] , [8] we obtain the following areas:

- Risk aversion area [9]--------- where $f'>0$ and $f''<0$
- Risk proneness area[10] ------- where $f'>0$ and $f''\geq 0$
- Incoherence area[11] -----------where $f'\leq 0$ or f' with different sign in [0 ; 1]
- Area which satisfies both D.A.R.A. (decreasing absolute risk aversion) and I.R.R.A. (increasing relative risk aversion) conditions. We find this area inside the risk aversion area[12].

The mentioned reference areas are plotted in the two graphs below:

Figure 1. Plot of risk aversion, risk proneness and incoherence areas (*x* is assumed in 0-1)

[6] It is handy because a third degree equation has an algebraic solution.
[7] It is possible to find an empty set for instance if the decision maker do not use the same *f* across the whole set of choices.
[8] Even if actual money amounts can be very important in choices, in the exam of a particular set of lotteries is always possible to put for instance the lower amount to 0 and the upper amount to 1, proportioning consequently all the others.
[9] Defined for $c_2 \leq -3$ and $c_2 > -1,5 - 0,5\ c_1$
[10] Defined for $c_2^2 > 3\ c_1$ where c_1 is in [0 – 3] or $c_2 > -3$ where $c_1 > 3$
[11] Consisting in the remaining part of R^2 (particularly we have $f' \leq 0$ if $c_1 \leq 0$ and $c_2 \leq -1,5 - 0,5\ c_1$)
[12] Particularly for $2c_2^2/3 < c_1 < -3c_2/(c_2+6)$

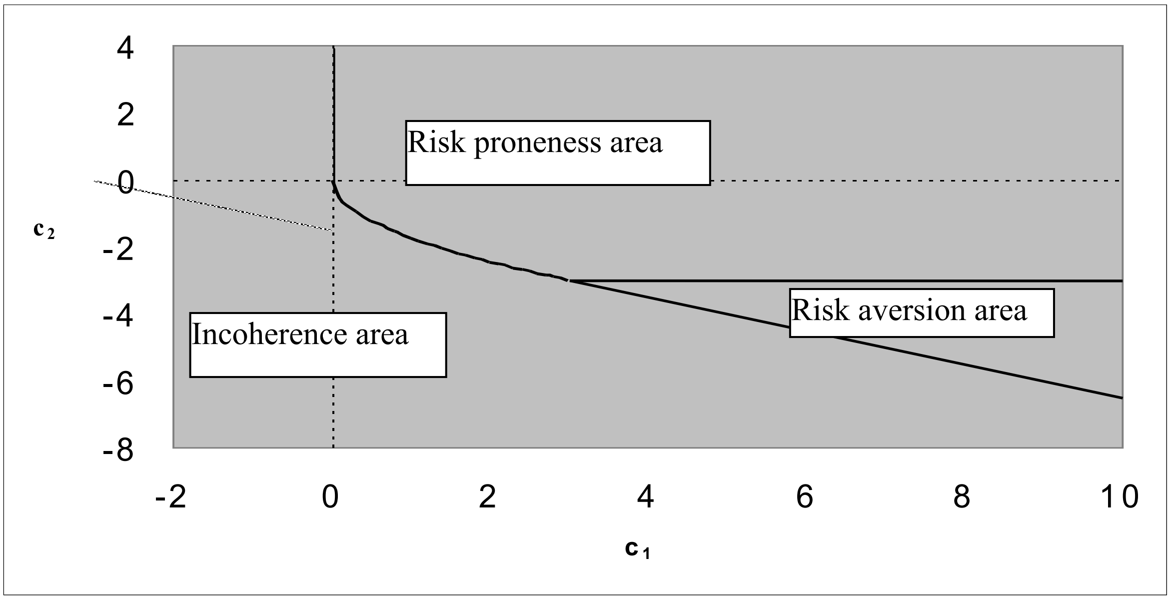
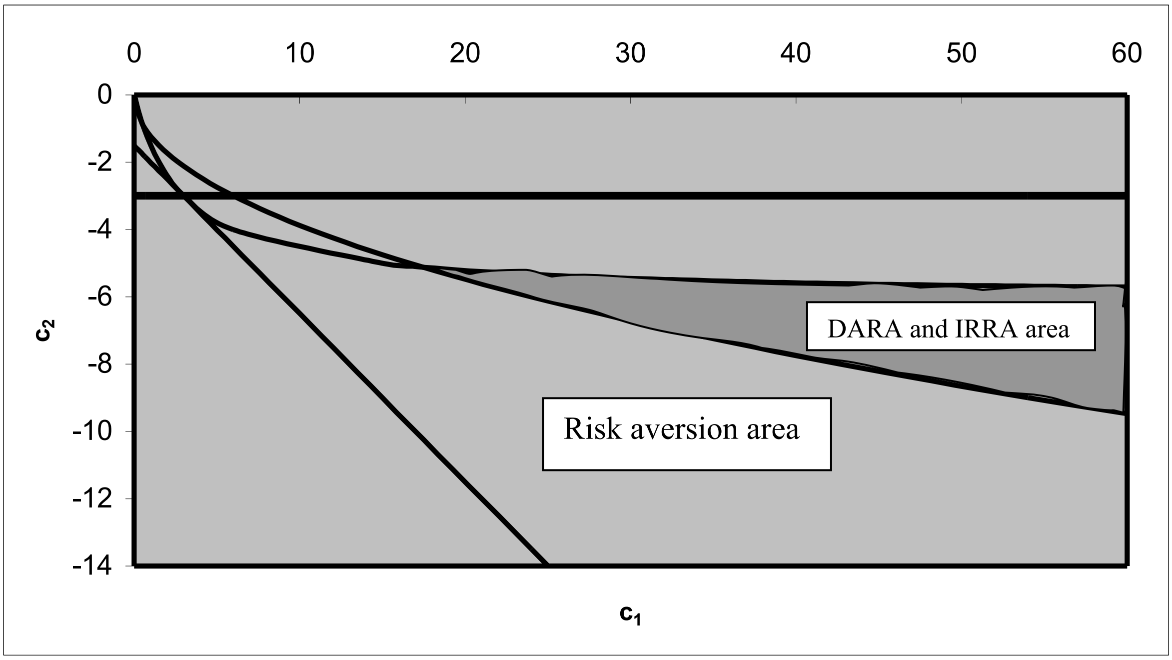
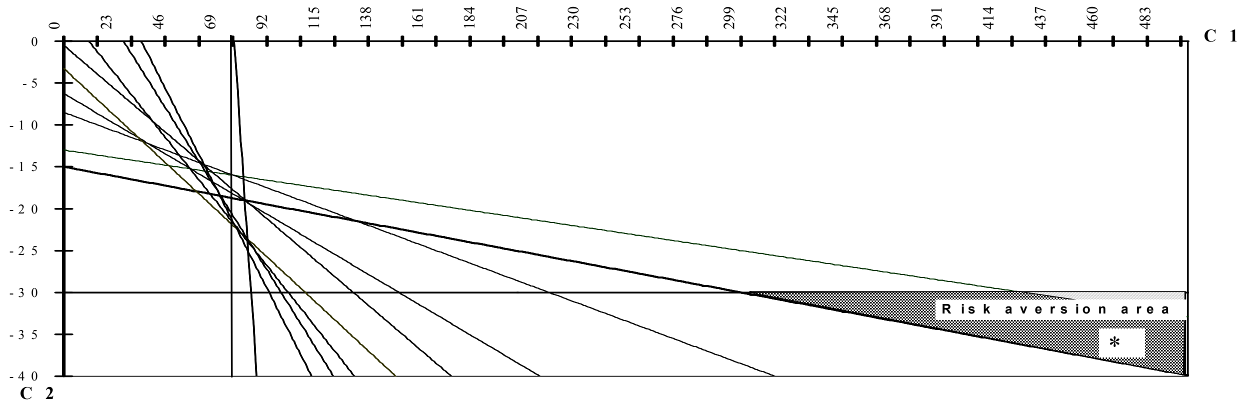


Figure 2. Plot of risk aversion, risk proneness and incoherence areas (x is assumed in [0;1])



Putting together the area representing the set of individually acceptable coefficients and some reference areas, we can identify a particular subject behaviour depending on his choices, as shown for instance in figure 3.

Figure 3. Example of plot for one subject during a set of lotteries: area * (a trapezium) is the one chosen by the subject and it is inside the "Risk aversion area" (the triangular one)



4. The surveys: some results. Till now we have carried out two pilot tests in the nineties and a little wider survey whose exam was closed in 2001. We discuss them separately.

4.1. The pilot tests. The first two pilot tests were based on the exam of small groups of students (20 each) in the Novara Faculty of Economics.

We briefly discuss some results of one of them, the other one being similar. The test was based on three sets of lotteries[13] asked to be put in preferential order by each subject, first pairwise and then in a complete ranking way. The first two sets involved the same group of people, while the third a different one. It was asked each subject to answer a short (about 20 questions) questionnaire[14] too, about some of his/her demographic, taste, life style characteristics. The following table summarizes some behaviour characteristics:

Table 1. Behaviour attitudes in choices, and difference between pairwise and full ranking choices

	SET I				SET II				SET III			
Pair wise	*Compl ranking* R.A	R.P	INC	*Tot*	*Compl ranking* R.A	R.P	INC	*Tot*	*Compl ranking* R.A	R.P	INC	*Tot*
R.A	12	1		13	5	1		6	14			14
R.P	1	1		2	1	5	1	7	1	1		2
INC	2	1	1	4	2	2		4	3			3
IRR		1		1	1	2		3			1	1
Tot	15	4	1	20	9	10	1	20	18	1	1	20

Legenda : R.A. means risk aversion
R.P. means risk proneness
INC. means incoherence (empty set for f coefficients)
IRR. means irrationality (some circularities in preferences)

[13] We present them in Appendix, point a.

[14] For sake of shortness we do not present the questionnaire. The items related to the more interesting results are summarized in table 2.

It can be observed that sets 1 and 3 exhibit quite close distributions, even though these two sets involved different people. Set 2 instead looks very different even if it involved the same people as set 1. Besides comparing lotteries looking at their first three moments, in set 1 and 3 the choice seems to be more complex (in set 2 for each choice there is always a strict dominance of the moments accordingly with a risk aversion behaviour)[15]. So, it seems relevant to explore situations in which decision makers do not vary their f too much by organizing experiments with some sets of lotteries examined by the same group of people.
Complete ranking helps subjects to avoid circularities and some other form of incoherence, but we also note that in complete ranking both risk averse and risk prone behaviour grow. So, passing from pairwise choices to a complete ranking choice would just clarify risk attitude, but the small numbers involved do not allow strong conclusions.
Incoherence includes the case in which f is changed too much during comparisons. It can happen obviously more easily during pairwise comparisons than in complete ranking.
We close speaking of a possible linkage between the displayed behaviour and some life style, personality and social attitudes. For this purpose we build a "risk aversion level" variable obtained by considering the number of times each subject chooses a risk averse set. We considered three levels for this variable : high, middle and low. By crosstabulating this variable with the questionnaire items we put in evidence some of them on which a further experimentation seems to be promising. In table 2 we show some leading tendencies :

Table 2. Leading tendencies (linking some questionnaire items to risk aversion)

Conditional sub-sample	*Risk aversion level*		
	Low	*Middle*	*High*
Working students	-	=	+
Student spending little time in bars and restaurants	-	-	+
Students liking travels during holidays	+	=	-

Legenda : + means that the row percentage in this group is at least 50% more than the whole sample percentage
- means that the row percentage in this group is at least 50% less than the whole sample percentage
= stands for the other cases

4.2. The latest survey. This survey - organized learning from pilot tests to control the relevant students' characteristics - involves a non probabilistic sample of 60 decision makers chosen among students of the Torino Faculty of Economics with a low level of knowledge about probability theory and close to graduation, and so more directly interested in working problems. Besides, the sampling subgroups allow to compare results by sex (31 males and 28 female) and by working status (33 working students and 27 not working ones). [16]

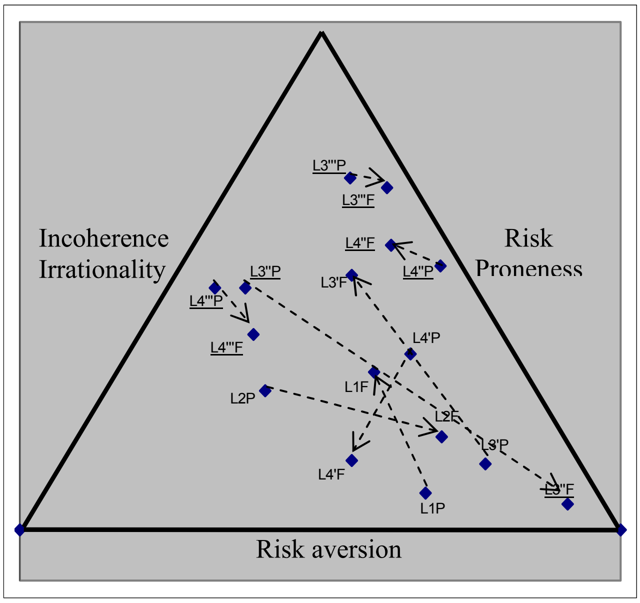
[15] See Appendix, point a.
[16] The experimental situation is not so far from the desirable one in which crosstabulating sex and work we should obtain four groups of 15 observations each. In practice we have the following distribution:

	Not Working	Working	Total
Males	15	16	31
Females	12	16	28
Total	27	32	59

Each decision maker had to carry out the choices corresponding to four sets of lotteries (the first two sets were equal for all subjects, the other two different across three groups of 20 people each) in two different ways for each set: first comparing lotteries pairwise and then all together (full ranking choices). Not all decision makers completed answers about full ranking choices. At last each subject was requested to answer a questionnaire about his (or her) social, demographic and life style characteristics. One subject did not finish this section.
Accordingly with the above observations on analysing inner attitudes, we can show how they are influenced by the kind of choices the decision makers face. Some results are shown in the following table and graph concerning relative frequency of subjects who exhibited a particular behaviour (risk aversion, etc.) in each set of lotteries.

Table 1. Behaviour profiles of each set of lotteries

		Behaviour profile				
Lotteries	Labels	Risk Avers.	Incoher. Irration.	Risk Pron.	Tot.	Obs.
Set1 pairwise	L1P	0,08	0,63	0,28	1,00	60
Set2 pairwise	L2P	0,32	0,25	0,43	1,00	60
Set3;1°group pairwise	L3'P	0,15	0,70	0,15	1,00	20
Set3;2°group pairwise	L3"P	0,55	0,10	0,35	1,00	20
Set3;3°group pairwise	L3'"P	0,80	0,15	0,05	1,00	20
Set4;1°group pairwise	L4'P	0,40	0,45	0,15	1,00	20
Set4;2°group pairwise	L4"P	0,60	0,40	0,00	1,00	20
Set4;3°group pairwise	L4'"P	0,55	0,05	0,40	1,00	20
Set1 full-ranking	L1F	0,36	0,41	0,23	1,00	39
Set2 full-ranking	L2F	0,21	0,60	0,19	1,00	52
Set3;1°group full-rank.	L3'F	0,58	0,26	0,16	1,00	19
Set3;2°group full-rank.	L3"F	0,06	0,88	0,06	1,00	17
Set3;3°group full-rank.	L3'"F	0,78	0,22	0,00	1,00	18
Set4;1°group full-rank.	L4'F	0,16	0,47	0,37	1,00	19
Set4;2°group full-rank.	L4"F	0,65	0,29	0,06	1,00	17
Set4;3°group full-rank.	L4'"F	0,44	0,17	0,39	1,00	18



In the table are considered risk aversion, risk proneness and incoherence or irrationality of decision makers' behaviours in different sets of choices. This classification is obtained by considering the area of the subject as in figure 3. In particular, incoherence and irrationality (circularities) correspond both to an empty area.
Each row of the table shows the three percentages (that is, the conditional distribution) of the type of behaviour shown by people who where asked to make their choices over the set of lotteries proposed by the row description itself. Hence the total is 1. The number of observations of each row is also reported.
The graph displays each set in the three dimensions, which represent these percentages. Because of the sum condition, the sets can be shown in a triangle. The meaning of the position of a set in the

Note: we did not record the sex of a working student

graph is that the point is as far from the side corresponding to a particular behaviour as higher its percentage is.
We note that underlined sets, which correspond to lotteries with loss possibility, generally are in the upper part of the graph, where the percentage of risk averse behaviour is high.[17]
We also note, following the arrows, that going through from pairwise choices to full ranking choices for the same set of lotteries only sometimes we observe a smaller percentage of both incoherence and irrationality in the last type of choices, while in some cases this percentage grows from pairwise to full ranking choices. In fact with risk of loss we have one dramatic reduction two small ones and one small increase of this percentage, and without risk of loss we have two increases though less dramatic, and one only comparable reduction. Taking into account that full ranking method practically avoids circularities in choices (the so called irrationality), we can impute that fact only to incoherence which does not necessarily disappear. In an earlier pilot test we drew an opposite conclusion - which seemed to be obvious. The matter must be analysed deeper as it looks that the sample size is too small.
We also grouped the lotteries considering the easiness in choosing accordingly with the first three moment calculus. In fact, for some lotteries[18] all choices can be done only in one way if a higher mean a lower variance and a right asymmetry is preferred[19]. Nevertheless, the positions of these lotteries in the triangular graph are not concentrated in any particular subsurface, and so they do not point out a relationship between easiness in calculus (in the above sense) and a given behaviour.

Now we show some results obtained through the questionnaire, considering some relationships between personal behaviour (in the test) and some lifestyle, personality and social attitudes.
First, thinking about risk aversion, we consider again a "risk aversion level" variable based on the percentage of times that each subject chooses a risk averse set. We now use four levels for this variable[20] .
We begin by presenting the results about presence of work and sex, which are the characteristics concerning the sampling subgroups.

As it is possible to see in table 4 and in the right side graph[21], a particular behaviour characterizes people distinguished by "*having work*", "*not having work, but having a little fixed monthly sum*

[17] there is an exception for the lottery L3"F (Set3; 2°group; full-ranking).
[18] They are the lotteries: L2P (Set2; pairwise) , L2F (Set2 full-ranking) , L4'P (Set4; 1°group; pairwise) , L4'F (Set4; 1°group; full-ranking) , L4"P (Set4; 2°group; pairwise) L4"F (Set4; 2°group; full-ranking) , L4'"P (Set4;3°group; pairwise) L4'"F (Set4; 3°group; full-ranking.
[19] Obviously this way of choosing corresponds to a particular behaviour (risk aversion). The first three moment calculus is referred in the Appendix, point b.
[20] in the following tables from R.A.- - (the lower aversion) to R.A.+ + (the higher)
[21] The graph shows the behaviour of indexes obtained considering the column conditional distributions and then dividing each term of them for the corresponding term of the total column conditional distributions. For instance, in the case of table 4 we have firstly the conditional distributions and then the values of the graphed indexes.

Conditional distributions

	No income	From parents	Wage	Total
R.A.- -	0,00	0,39	0,20	0,22
R.A.-	0,25	0,17	0,27	0,23
R.A.+	0,33	0,17	0,27	0,25
R.A.+ +	0,42	0,28	0,27	0,30
Total	1,00	1,00	1,00	1,00

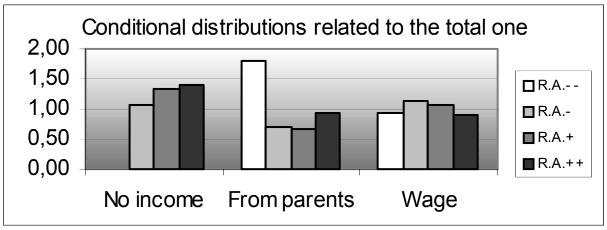
Indexes

	No income	From parents	Wage	Total
R.A.- -	0,00	1,79	0,92	1,00
R.A.-	1,07	0,71	1,14	1,00
R.A.+	1,33	0,67	1,07	1,00
R.A.+ +	1,39	0,93	0,89	1,00
Total	1,00	1,00	1,00	1,00

(from their family)" and "*not having work and no fixed monthly sum either"*. In fact, in this analysis we found the people with "*no income*" being more risk averse than the other two categories (and especially than the second one), while in an earlier pilot test we found a different behaviour. Perhaps, sometimes work carries more confidence toward risk and sometimes more aversion instead. [22]

Table 4. Risk aversion and monthly individual income

	No income	From parents	Wage	Total
R.A.- -	0	7	6	13
R.A.-	3	3	8	14
R.A.+	4	3	8	15
R.A.+ +	5	5	8	18
Total	12	18	30	60



Looking at sex, we can see in table 5 a little more risk averse attitude in females subjects.

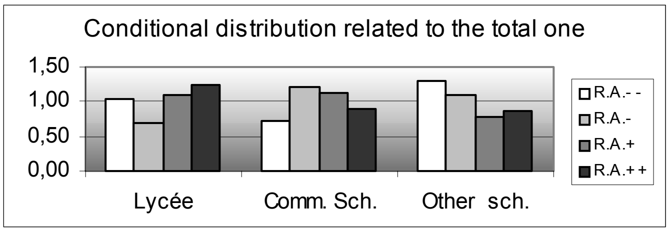
Table 5. Risk aversion and sex

	Male	Female	Total
R.A.- -	9	6	15
R.A.-	10	8	18
R.A.+	7	7	14
R.A.+ +	6	7	13
Total	32	28	60

Thinking about the educational qualification, table 6 shows a little more risk averse behaviour in students who attended a Lycée.

Table 6. Risk aversion and educational qualification

	Lycée	Commercial schools	Other schools	Total
R.A.- -	5	4	6	15
R.A.-	4	8	6	18
R.A.+	6	7	4	17
R.A.+ +	6	5	4	15
Total	21	24	20	60



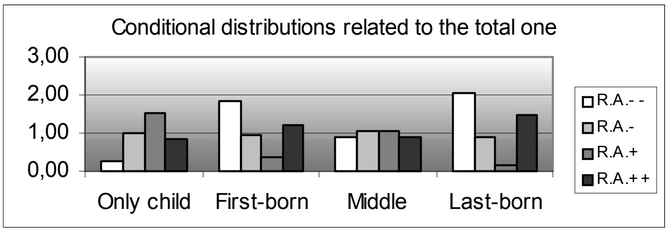
Some properties of these indexes are discussed in Bollani (1995).

[22] Nevertheless all these results are to be considered from an exploratory point of view, while a confirmatory analysis could be proposed as a further development.

With regard to the birth order[23], first-born and last-born subjects seems to prefer extreme situations (very risk averse people or - on the contrary - not averse at all), while only child subjects seems to prefer intermediate situations.

Table 7. Risk aversion and birth order

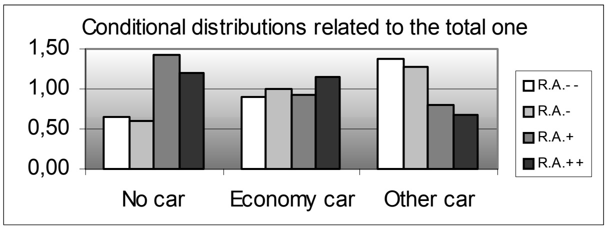
	Only child	First-born	In the middle[24]	Last-born	Total
R.A.- -	1	6	1	7	15
R.A.-	6	5	2	5	18
R.A.+	9	2	2	1	14
R.A.+ +	3	4	1	5	13
Total	19	17	6	18	60



Looking at the type of car, table 8 shows a higher tendency in risk aversion for those who do not have a car or those who have an economy car.

Table 8. Risk aversion and type of car

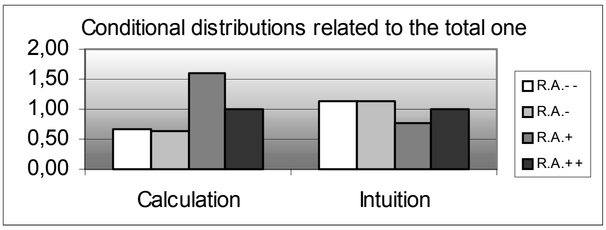
	No car	Economy car	Other car	Total
R.A.- -	2	5	6	13
R.A.-	2	6	6	14
R.A.+	5	6	4	15
R.A.+ +	5	9	4	18
Total	14	26	20	60



Then considering the way used in choosing between lotteries we see in table 9 a more risk averse behaviour for those who use calculations in choosing and not only intuition.

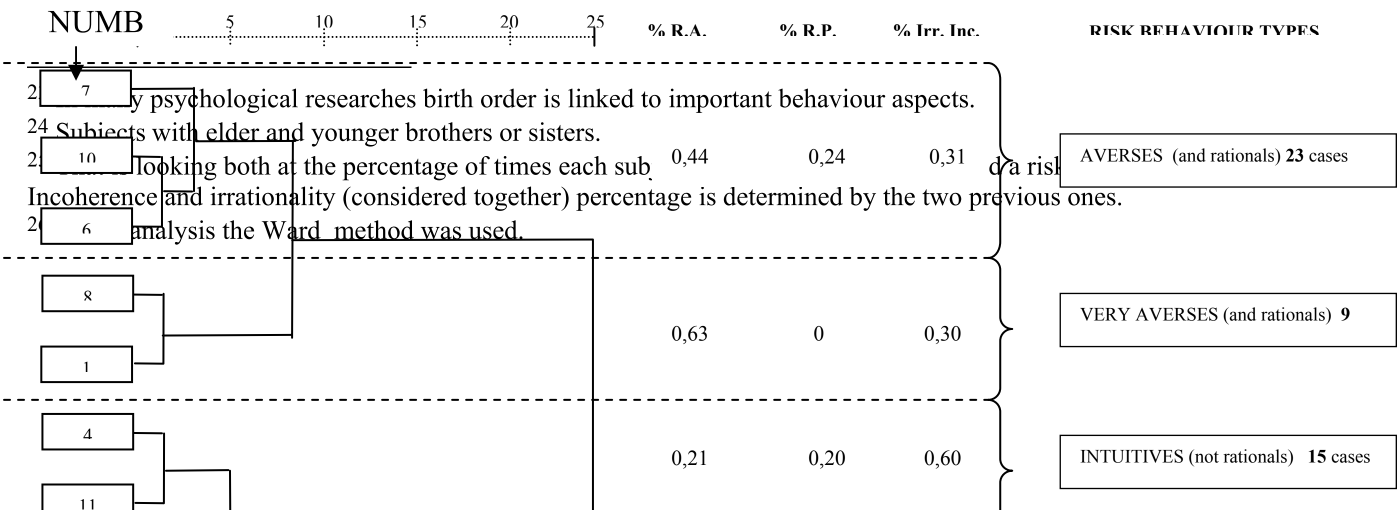
Table 9. Risk aversion and way of choice

	Calculation	Intuition	Total
R.A.- -	2	9	11
R.A.-	2	10	12
R.A.+	6	8	14
R.A.+ +	4	11	15
Total	14	38	52



In order to take care of risk attitudes (both "averse" and "prone"),[25] we also consider a grouping variable obtained trough a cluster analysis.[26] The results are shown in Figure 3.

Figure 3. Cluster analysis for the types of choices



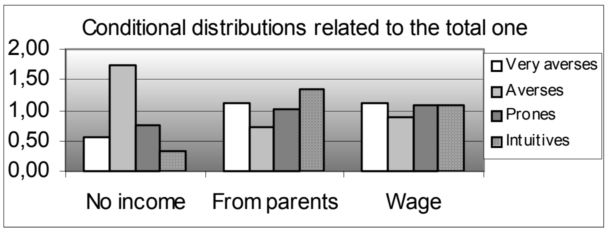
[23] [illegible]y psychological researches birth order is linked to important behaviour aspects.
[24] Subjects with elder and younger brothers or sisters.
[25] [illegible] looking both at the percentage of times each sub[illegible]d a risk[illegible] Incoherence and irrationality (considered together) percentage is determined by the two previous ones.
[26] [illegible] analysis the Ward method was used.

Now we compare the results discussed using the "risk aversion level" variable with the corresponding ones obtained using the cluster analysis. We present the same tables as before organized using a cluster variable.

Looking at the individual income we note again that the risk aversion of "*no income*" group and we also see that in this group irrational behaviour is lower than in the other two ones. [27]

Table 10. Behaviour typology and monthly individual income

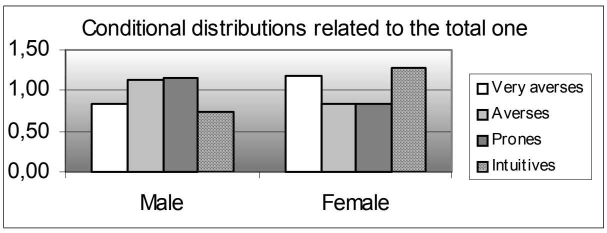
	No income	From parents	Wage	Total
Very averses	1	3	5	9
Averses	8	5	10	23
Prones	2	4	7	13
Intuitives	1	6	8	15
Total	12	18	30	60



Looking at sex we note in table 11 a little less rational behaviour in female subjects. The high index of the "*very averse*" cluster seems to confirm the results of table 5 (anyway we have to remember that the "*very averse*" cluster is very little - only nine people - and the tendency shown in table 5 is not very high).

Table 11. Behaviour typology and sex

	Male	Female	Total
Very averses	4	5	9
Averses	14	9	23
Prones	8	5	13
Intuitives	6	9	15
Total	32	28	60

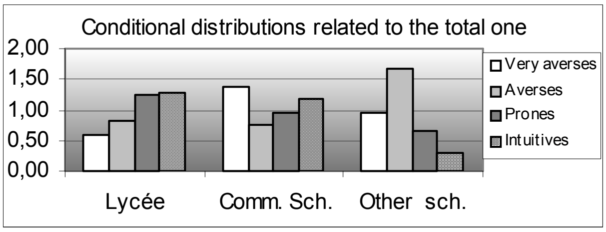


[27] By interpreting these results it is important to remark that the "*very averse*" cluster is very small.

Considering educational qualification we note a smaller risk aversion in the Lycée than in the Commercial schools.

Table 12. Behaviour typology and educational qualification

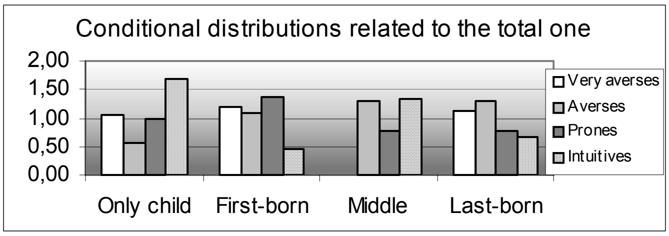
	Lycée	Commercial schools	Other schools	Total
Very averses	2	5	2	9
Averses	7	7	9	23
Prones	6	5	2	13
Intuitives	7	7	1	15
Total	22	24	14	60



Thinking of the birth order we find only child subjects to be less rational than the other groups.

Table 13. Behaviour typology and birth order

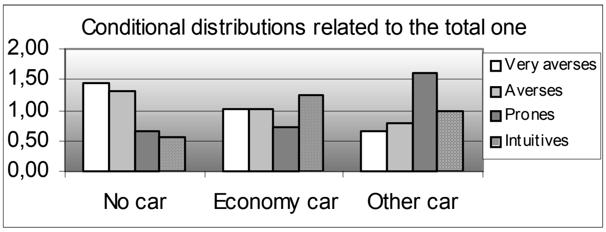
	Only child	First-born	In the middle[23]	Last-born	Total
Very averses	3	3	-	3	9
Averses	4	7	3	9	23
Prones	4	5	1	3	13
Intuitives	8	2	2	3	15
Total	19	17	6	18	60



Looking at the type of car we note again a higher tendency in risk aversion for those who do not have a car (in this group there is also a less irrational behaviour), while the behaviour of people who has a not-economy car seems to be more risk prone.

Table 14. Behaviour typology and type of car

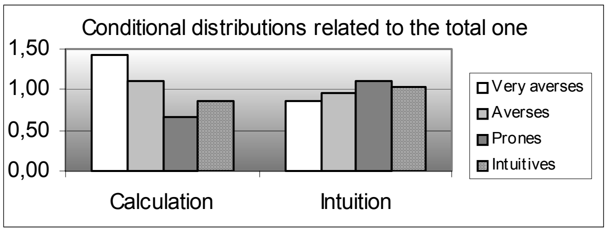
	No car	Economy car	Other car	Total
Very averses	3	4	2	9
Averses	7	10	6	23
Prones	2	4	7	13
Intuitives	2	8	5	15
Total	14	26	20	60



At last considering the way used in choosing between lotteries we more evidently confirm the comment of table 9 pointing out a more risk averse behaviour for those who use calculations in choosing and not only intuition.

Table 15. Behaviour typology and way of choice

	Calculation	Intuition	Total
Very averses	3	6	9
Averses	6	17	23
Prones	2	11	13
Intuitives	3	12	15
Total	14	46	60



Many other results could be presented (looking at the richness of the questionnaire),[28] but till now, in our exploratory analysis, we limit our attention only on the more interesting relationships we found.

[28] It is presented in the Appendix, point c.

Appendix

a. Lotteries used for the pilot test discussed in section 4

On the left side of the page the lotteries are shown, on the right side an evaluation based on the first three moment calculus is also referred. The symbol >> means “to be preferred to” for a risk averse decision maker, exhibiting a strict dominance according to the three moments together with risk aversion, and the symbol > (when is used to compare lotteries) means the same but in a weaker sense, that is considering only the first two moments, while the third gives opposite information. Besides “*as”* means the third moment

FIRST SET OF LOTTERIES

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
0				0.05	
100000		0.80			0.50
300000			0.60		0.10
500000	1			0.85	
700000			0.40		0.40
1000000		0.20		0.10	

Preference	Moments
$L_1 > L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1< as_2$
$L_1 > L_3$	$\mu_1>\mu_3$; $\sigma^2_1<\sigma^2_3$; $as_1< as_3$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1< as_4$
$L_1 > L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1 < as_5$
$L_3 > L_2$	$\mu_3>\mu_2$; $\sigma^2_3<\sigma^2_2$; $as_3< as_2$
$L_4 > L_2$	$\mu_4>\mu_2$; $\sigma^2_4<\sigma^2_2$; $as_4< as_2$
$L_5 > L_2$	$\mu_5>\mu_2$; $\sigma^2_5<\sigma^2_2$; $as_5< as_2$
$L_4 >> L_3$	$\mu_4>\mu_3$; $\sigma^2_4<\sigma^2_3$; $as_4> as_3$
$L_3 >> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3> as_5$
$L_4 >> L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4> as_5$

SECOND SET OF LOTTERIES

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
100000				0,15	
200000				0,25	0,40
300000		0,60			
400000	0,65				
500000			0,70		
600000					0,35
700000				0,60	
800000		0,40			0,25
900000	0,35				
1000000			0,30		

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_3 >> L_1$	$\mu_3>\mu_1$; $\sigma^2_3<\sigma^2_1$; $as_3> as_1$
$L_1 >> L_4$	$\mu_1>\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 >> L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1> as_5$
$L_3 >> L_2$	$\mu_3>\mu_2$; $\sigma^2_3<\sigma^2_2$; $as_3> as_2$
$L_2 >> L_4$	$\mu_2>\mu_4$; $\sigma^2_2<\sigma^2_4$; $as_2> as_4$
$L_2 >> L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_2> as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3 > as_4$
$L_3 >> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3> as_5$
$L_5 >> L_4$	$\mu_5>\mu_4$; $\sigma^2_4<\sigma^2_5$; $as_5> as_4$

THIRD SET OF LOTTERIES

AMOUNTS	PROBABILITY				
(Lire)	L1	L2	L3	L4	L5
0		0.30		0.20	0.50
200000	0.40				
400000		0.30			0.10
600000	0.40				
800000		0.40	1	0.60	0.40
1000000	0.20			0.20	

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_3 > L_1$	$\mu_3>\mu_1$; $\sigma^2_3<\sigma^2_1$; $as_3< as_1$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 > L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1< as_5$
$L_3 > L_2$	$\mu_3>\mu_2$; $\sigma^2_3<\sigma^2_2$; $as_3< as_2$
L_4 ; L_2	$\mu_4>\mu_2$; $\sigma^2_4>\sigma^2_2$; $as_4< as_2$
$L_2 > L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_5 > as_2$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_4< as_3$
$L_3 > L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3< as_5$
$L_4 > L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4< as_5$

b. Lotteries used for the last survey discussed in section 4

On the left side of the page the lotteries are shown, on the right side an evaluation based on the first three moment calculus is also referred. The symbol >> means "to be preferred to" for a risk averse decision maker, exhibiting a strict dominance according to the three moments together with risk aversion, and the symbol > (when is used to compare lotteries) means the same but in a weaker sense, that is considering only the first two moments, while the third gives opposite information. Besides "*as*" means the third moment

FIRST SET OF LOTTERIES

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
0				0.05	
100000		0.80			0.50
300000			0.60		0.10
500000	1			0.85	
700000			0.40		0.40
1000000		0.20		0.10	

Preference	Moments
$L_1> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1< as_2$
$L_1> L_3$	$\mu_1>\mu_3$; $\sigma^2_1<\sigma^2_3$; $as_1< as_3$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1< as_4$
$L_1> L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1< as_5$
$L_2< L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2> as_3$
$L_2< L_4$	$\mu_2<\mu_4$; $\sigma^2_2>\sigma^2_4$; $as_2> as_4$
$L_2< L_5$	$\mu_2<\mu_5$; $\sigma^2_2>\sigma^2_5$; $as_2> as_5$
$L_3<< L_4$	$\mu_3<\mu_4$; $\sigma^2_3>\sigma^2_4$; $as_3< as_4$
$L_3> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3< as_5$
$L_4> L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4< as_5$

SECOND SET OF LOTTERIES

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
100000				0,15	
200000				0,25	0,40
300000		0,60			
400000	0,65				
500000			0,70		
600000					0,35
700000				0,60	
800000		0,40			0,25
900000	0,35				
1000000			0,30		

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 << L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1< as_3$
$L_1 >> L_4$	$\mu_1>\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 >> L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1> as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
$L_2 >> L_4$	$\mu_2>\mu_4$; $\sigma^2_2<\sigma^2_4$; $as_2> as_4$
$L_2 >> L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_2> as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 >> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3> as_5$
$L_4 << L_5$	$\mu_4<\mu_5$; $\sigma^2_4>\sigma^2_5$; $as_4< as_5$

THIRD SET OF LOTTERIES GROUP 1

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
0		0.30		0.20	0.50
200000	0.40				
400000		0.30			0.10
600000	0.40				
800000		0.40	1	0.60	0.40
1000000	0.20			0.20	

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 < L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1> as_3$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 > L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1< as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
L_2 ; L_4	$\mu_2<\mu_4$; $\sigma^2_2<\sigma^2_4$; $as_2> as_4$
$L_2 > L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_2< as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 > L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3< as_5$
$L_4 > L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4< as_5$

THIRD SET OF LOTTERIES GROUP 2

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
-200000		0.30		0.20	0.50
0	0.40				
200000		0.30			0.10
400000	0.40				
600000		0.40	1	0.60	0.40
800000	0.20			0.20	

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 < L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1> as_3$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 > L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1< as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
L_2 ; L_4	$\mu_2<\mu_4$; $\sigma^2_2<\sigma^2_4$; $as_2> as_4$
$L_2 > L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_2< as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 > L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3< as_5$
$L_4 > L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4< as_5$

THIRD SET OF LOTTERIES GROUP 3

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
-500000		0.30		0.20	0.50
-300000	0.40				
-100000		0.30			0.10
100000	0.40				
300000		0.40	1	0.60	0.40
500000	0.20			0.20	

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 < L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1> as_3$
L_1 ; L_4	$\mu_1<\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 > L_5$	$\mu_1>\mu_5$; $\sigma^2_1<\sigma^2_5$; $as_1< as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
L_2 ; L_4	$\mu_2<\mu_4$; $\sigma^2_2<\sigma^2_4$; $as_2> as_4$
$L_2 > L_5$	$\mu_2>\mu_5$; $\sigma^2_2<\sigma^2_5$; $as_2< as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 > L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3< as_5$
$L_4 > L_5$	$\mu_4>\mu_5$; $\sigma^2_4<\sigma^2_5$; $as_4< as_5$

FOURTH SET OF LOTTERIES GROUP 1

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
0		0,35			
100000				0,30	
300000	0,30				
400000					
500000				0,10	
600000					0,40
700000		0,65	0,20		
800000			0,50	0,60	0,40
900000	0,70				0,20
1000000			0,30		

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 << L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1< as_3$
$L_1 >> L_4$	$\mu_1>\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 << L_5$	$\mu_1<\mu_5$; $\sigma^2_1>\sigma^2_5$; $as_1< as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
$L_2 << L_4$	$\mu_2<\mu_4$; $\sigma^2_2>\sigma^2_4$; $as_2< as_4$
$L_2 << L_5$	$\mu_2<\mu_5$; $\sigma^2_2>\sigma^2_5$; $as_2< as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 >> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3> as_5$
$L_4 << L_5$	$\mu_4<\mu_5$; $\sigma^2_4>\sigma^2_5$; $as_4< as_5$

FOURTH SET OF LOTTERIES GROUP 2

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
-500000		0,35			
-400000				0,30	
-200000	0,30				
-100000					
0				0,10	
100000					0,40
200000		0,65	0,20		
300000			0,50	0,60	0,40
400000	0,70				0,20
500000			0,30		

Preference	Moments
$L_1 >> L_2$	$\mu_1>\mu_2$; $\sigma^2_1<\sigma^2_2$; $as_1> as_2$
$L_1 << L_3$	$\mu_1<\mu_3$; $\sigma^2_1>\sigma^2_3$; $as_1< as_3$
$L_1 >> L_4$	$\mu_1>\mu_4$; $\sigma^2_1<\sigma^2_4$; $as_1> as_4$
$L_1 << L_5$	$\mu_1<\mu_5$; $\sigma^2_1>\sigma^2_5$; $as_1< as_5$
$L_2 << L_3$	$\mu_2<\mu_3$; $\sigma^2_2>\sigma^2_3$; $as_2< as_3$
$L_2 << L_4$	$\mu_2<\mu_4$; $\sigma^2_2>\sigma^2_4$; $as_2< as_4$
$L_2 << L_5$	$\mu_2<\mu_5$; $\sigma^2_2>\sigma^2_5$; $as_2< as_5$
$L_3 >> L_4$	$\mu_3>\mu_4$; $\sigma^2_3<\sigma^2_4$; $as_3> as_4$
$L_3 >> L_5$	$\mu_3>\mu_5$; $\sigma^2_3<\sigma^2_5$; $as_3> as_5$
$L_4 << L_5$	$\mu_4<\mu_5$; $\sigma^2_4>\sigma^2_5$; $as_4< as_5$

FOURTH SET OF LOTTERIES GROUP 3

AMOUNTS	PROBABILITY				
(Lire)	L_1	L_2	L_3	L_4	L_5
-200000		0,35			
-100000				0,30	
100000	0,30				
200000					
300000				0,10	
400000					0,40
500000		0,65	0,20		
600000			0,50	0,60	0,40
700000	0,70				0,20
800000			0,30		

Preference	Moments
L1 >> L2	$\mu 1>\mu 2$; $\sigma 21<\sigma 22$; as1> as2
L1 << L3	$\mu 1<\mu 3$; $\sigma 21>\sigma 23$; as1< as3
L1 >> L4	$\mu 1>\mu 4$; $\sigma 21<\sigma 24$; as1> as4
L1 << L5	$\mu 1<\mu 5$; $\sigma 21>\sigma 25$; as1< as5
L2 << L3	$\mu 2<\mu 3$; $\sigma 22>\sigma 23$; as2< as3
L2 << L4	$\mu 2<\mu 4$; $\sigma 22>\sigma 24$; as2< as4
L2 << L5	$\mu 2<\mu 5$; $\sigma 22>\sigma 25$; as2< as5
L3 >> L4	$\mu 3>\mu 4$; $\sigma 23<\sigma 24$; as3> as4
L3 >> L5	$\mu 3>\mu 5$; $\sigma 23<\sigma 25$; as3> as5
L4 << L5	$\mu 4<\mu 5$; $\sigma 24>\sigma 25$; as4< as5

c. Questionnaire used for the last survey discussed in section 4

Svolge un' attività lavorativa? *Have you a job?*	☐ No ☐ Sì Tipo di lavoro.......*(Kind of job…)*
Se no, riceve una paga dai suoi genitori? *If not, are your parents giving you some money regularly?*	☐ Settimanale *(every week)* ☐ Mensile *(every month)* ☐ Altro *(other)* ☐ Non ho una paga *(No, they are not)*
Quanto ha speso nell' ultimo mese per il tempo libero ? *How much did you spent last month for free time?*	....
Con che assiduità (mensile) frequenta i locali pubblici ? *How many times in a month are you going outside?*	Cinema....................................... Discoteche *(Discoteques)*.......... Bar(Pub,eccetera...).................. Ristoranti *(Restaurants)*.........…
Con chi abita ? *With whom are you living?*	☐ Solo *(Alone)* ☐ Con i genitori *(With your parents)* ☐ In un proprio nucleo famigliare *(With your own family)* ☐ Altro (specificare)... *(Other(specify…..))*.....
La casa in cui abita è : *The house where you are living is:*	☐ Di proprietà *(Your own)* ☐ In affitto *(Rented)* ☐ Altro(specificare….) *(Other(specify…..))*
Usa abitualmente l'automobile ? *Do you usually drive a car?*	☐ No ☐ Sì
Se si, l'auto che usa abitualmente è: *If yes, this car is:*	☐ Di proprietà *(Your own)* ☐ Genitori *(Owned by your parents)* ☐ Altro(specificare…) *(Other(specify…))*
Se si che tipo di auto è: *If yes, which kind of car is it?*	☐ Utilitaria *(Eeconomy car)* ☐ Media *(Intermediate)* ☐ Segmento superiore *(High level)* ☐ Altro (specificare) *(Other(specify…))*………….
Usa mezzi pubblici ? *Do You use busses, trams, and so on?*	☐ No ☐ Sì
Se si, con quale frequenza ? *If yes, how frequently?*	☐ Giornaliera *(Every day)* ☐ Settimanale *(Every week)* ☐ Mensile *(Every month)*
Nell'ultimo anno ha fatto viaggi all'estero ? *Last year did you travel abroad?*	☐ No ☐ Sì
Va via durante i week-end ? *Do you go away during week-ends?*	☐ No ☐ Sì
Nell' ultimo anno ha fatto la settimana bianca ? *Last year did you have a winter holiday week?*	☐ No ☐ Sì
Nell' ultimo anno ha fatto le vacanze estive ? *Last year did you have summer holidays?*	☐ No ☐ Sì
Se si, quanti giorni sono durate ? *If yes, how many days?*	……………………………………………
Se si, dove ha alloggiato ? *If yes, you were in:*	☐ Hotel..................................……….….. ☐ Appartamento.*(Flat)*....................…… ☐ Campeggio..*(Camping)*......……….….. ☐ Altro(specificare).*(Other(specify*......))..
Quali sport pratica ? *Which sports do you like?*	....…………..

Nell' ultimo trimestre quante volte è andato dal parrucchiere ? *Last three months how many times did you go to the hairdresser(or barber)?*	……………………………………………	
Di quante persone è composto il suo nucleo famigliare ? *How many people are there in your family?*	....…………..	
Ha fratelli/sorelle ? *Have you brothers/sisters?*	□ No □ Sì numero *(number)*…………………………..	
Se si, ha fratelli/sorelle maggiori ? *If yes, have you elder brothers/sisters?*	□ No □ Sì numero fratelli *(brother's number)*. numero sorelle*(sister's number)*.	
Se si, ha fratelli/sorelle gemelli ? *If yes, have you twin brothers/sisters?*	□ No □ Sì numero *(number)*………………………………..	
Qual è il titolo di studio dei suoi genitori? *What is your parents' degree?*	Madre *(Mother)* : A.□ Elementari *(Primary school)* B.□ Media *(Junior high school)* C.□ Superiori *(Senior high school)* D.□ Università *(University)* E. □ Altro……...*(Other)*..........	Padre *(Father)* : A.□ Elementari B.□ Medie C.□ Superiori D.□ Università E. □ Altro............
In quale settore lavorano/hanno lavorato i suoi genitori ? *In which sector your parents do/did work?*	Madre *(Mother)* : □ Industria *(Industry)* □ Servizi *(Services)* □ Agricoltura *(Agricolture)* □ Casalinga *(Housewife)* □ Altro... ……...*(Other)*...........	Padre *(Father)* : A.□ Industria B.□ Servizi C.□ Agricoltura D.□ Altro..........
Tipo di professione esercitata ? *Kind of job*	Madre *(Mother)* : □ Libera professione *(Profession)* □ Imprenditore *(Entrepreneur)* □ Artigiano *(Artisan)* □ Lav. dipendente *(Subordinate)* □ Altro...... …...*(Other)*.........	Padre *(Father)* : A.□ Libera professione B.□ Imprenditore C.□ Artigiano D.□ Lav. dipendente E. □ Altro..........
Sesso *(Sex)*	□ Maschile *(Male)* □ Femminile *(Female)*	
Età *(Age)*	....…………..	
Anno di iscrizione *(Matriculation year)*	....…………..	
Come investirebbe una somma di denaro nel mercato finanziario? *In which way would you invest a sum of money in the financial market?*	A.□ Azioni *(Shares)* B.□ Obbligazioni/titoli di stato *(Bounds)* C.□ Combinazione di entrambi *(Both)* D.□ Altro (specificare) *(Other(specify..))*	
Ha sostenuto l'esame di Matematica Generale ? *Did you pass math exam?*	□ No □ Sì	
Se si, con quale voto ? *If Yes, which was your mark?*	……………………………………………	
Titolo di studio ? *Scholarship degree*	……………………………………………	
Nel dare le preferenze alle lotterie *Choosing among lotteries*	A.□ Ha eseguito conteggi *(Did you do calculations)* B.□ Si è affidato all'intuito *(Did you use intuition)* C.□ Altro (specificare) *(Other(specify…))*	

References

Bollani L., 1995 "Analisi di un collettivo stratificato basata su più valutazioni dicotomiche individuali", *Statistica*, anno LV, n. 1

Chisini O.,1929 "Sul concetto di media", *Periodico di Matematiche*, Ser. 4, 9, 106-16

De Finetti B.,1931 "Sul concetto di media", *Giornale dell'Istituto Italiano degli Attuari*,2,369-96

________ ,1970 "*Teoria delle Probabilità. Sintesi introduttiva con Appendice Critica, Torino* : Einaudi (translated in English : *Theory of Probability : A Critical Introductory Treatment*, J. Wiley & Sons, New York, 1974, 1975)

Diale G.,1990 "*Building a utility function based on preferences between lotteries*", paper presented at FUR V

Margarita S., 1999 *"Sugli errori di approssimazione nel calcolo di medie associative"*, Quaderni del Dip. di Statistica e Matematica Applicata alle Scienze Umane "D. de Castro" - Università di Torino, n.7

Rossi G. A.,1990 "Rational behaviour", *Rivista internazionale di scienze economiche e commerciali*, 37

________ ,1991 "*Financial decisions : some foundations*", Istituto di Matematica Finanziaria dell'Università di Torino, Ser. 3, 63

________ ,1994a "Rational behaviour : a comparison between the theory stemming from the de Finetti's work and some other leading theories", *Theory and Decision*, 36 ; 257-75

________ ,1994b "Previsionless rational behaviour", *Rivista internazionale di scienze economiche e commerciali*, 41, 29-34

________ ,1994c "About explaining in decision theory", *Rivista internazionale di scienze economiche e commerciali*, 41, 997-1012

G.A. Rossi, L. Bollani, 2000 *"Surveys for checking decision makers qualities"*, in Proceedings 3nd International Workshop on Preference and Decision -Trento 2000, pagg 93-97, Dipartimento di Informatica e Studi Aziendali - Università di Trento

Rossi G. A., Tibiletti L.,1994 "*Higher order polynomial utility function : advantages in their use*", Quaderni del Dipartimento di Statistica e Matematica Applicata alle Scienze Umane"D. de Castro" - Università di Torino, n. 1.