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Lottery- and survey-based risk attitudes linked through a multichoice elicitation task

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Abstract

In this paper we compare two mutually uncorrelated risk-attitude elicitation tasks. In particular, we test for correlation of the elicited degrees of monetary risk aversion at a within-subject level. We show that sufficiently similar incentivized mechanisms elicit correlated decisions in terms of monetary risk aversion only if other risk-related attitudes are accounted for. Furthermore, we ask subjects to self-report their general willingness to take risks. We find evidence of some external validity of the two tasks as predictors of self-reported risk attitudes in general human domains.

Keywords: Risk aversion, Elicitation method, Lottery choices.

JEL classification: D81, C91

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1 Introduction

Experimental evidence and recent theories of individual decision making have acknowledged the fact there is more to a decision maker's attitude to risk than risk aversion alone. Concepts like loss aversion, reference points or aspiration levels, probability weighting and even violations of stochastic dominance are non-negligible aspects which are jointly or separately accounted for by modern theories aiming at accommodating previously disturbing and paradoxical phenomena.

However, several practitioners and the vast majority of experimental researchers seem to rely on risk aversion alone, when (the former) pricing a risky asset and (the latter) eliciting subjects' risk attitudes as an explanatory variable of their behavior in another decision making context. For example, in more than half of the occasions in which experimental economists wish to account for their subjects' risk attitudes as a primary or secondary aspect of their behavior, the Holt and Laury (2002) – *HL* hereafter – procedure is adopted, which is primarily a uni-dimensional test often used to map decisions on a uni-parametric utility function. A different procedure involves a survey question asking subjects to assess their attitude towards risk (self-assessed risk attitude). Interestingly, whether this is done by a single question or with a more complex test like Zuckerman's Sensation Seeking Scale (Zuckerman, 1994), even in this literature the variable used is a uni-dimensional construct assessing a person's overall riskiness. [1]

In this paper, we contrast both aforementioned methods, to choices in a Lottery-Panel Test (Sabater-Grande and Georgantzis, 2002) – *SG* hereafter –, this method disclosing more information on a decision maker's risk attitudes. Specifically, each participant makes a choice among a series (panel) of alternative lotteries. Four panels are constructed, each of which provides subjects with a different incentive (risk premium) to make riskier choices. A parametric approach to the test can offer a simple prediction on subjects' behavior across panels and is easily comparable with uni-dimensional mapping on the utility parameter space like in *HL*. The richness of patterns emerging as deviations from the expected-utility predicted behavior across panels, allows us to classify subjects according to criteria which are not applicable in simple models.

A rather surprising finding that is recurrently reported by different experimental studies is that risk attitudes elicited through different methods

[1] Weber et al. (2002) have introduced in the literature a psychometric scale that assesses risk taking in five different domains: financial decisions (separately for investing *vs.* gambling), health/safety, recreational, ethical, and social decisions. However, their elicitation method is *uni-dimensional* and it is the same across domains, unless framing of the question used to elicit self-assessed risk attitude in a *specific* domain. Furthermore, in this paper we do not focus on individual risk-taking behavior in different human domains. Rather, we measure the correlation across two incentivized tasks – a uni-dimensional and a *multi-dimensional* one – and between the former and self-assessed risk attitude in *general* human domains.

differ significantly from each other.[2] Several aspects of this finding relate to the mere nature of the tasks. For example, tasks with losses are naturally expected to capture different dimensions of subjects' psychological attitudes as compared to tasks limited to the gains domain. Furthermore, it is rather easily accepted that tasks covering different payoff ranges would also lead to significant differences in the elicited attitudes.

The consequences of accepting such differences as natural can be of two types. First, those concerning the relation between the elicitation task and the underlying theoretical decision-making model under risk, and, second, those related to the usefulness of the task as a method of obtaining an explanatory variable to empirically capture the role of subjects' risk attitude on his/her behavior in a different task. Both issues are largely neglected, not so much by the studies specifically designed to compare risk attitudes elicited through different tasks, but by those acting as *simple users* of the tasks as a method of generating a risk-attitude related explanatory variable for their primary data from an experiment.

Regarding the first issue, the most striking feature of a number of broadly used tasks is their dependence on a single choice made by each subject. It is straightforward to see why such a strategy is both tautologically consistent with any uniparametric description of the decision problem solved by the decision maker, and in dissonance with all modern theories based by definition on more than the product of probabilities with the uniparametric utility transformation of the associated monetary outcomes.[3]

Regarding the second issue, we feel that it can be, at the same time, more urgent to address and less problematic. This is so because there seems to be some consensus on the intuitive but not sufficiently supported fact that decisions made across similar tasks should be expected to elicit attitudes which do not significantly differ from each other. Of course, one should not forget that even the repetition of exactly the same task by the same individual would most probably lead to differences. But such differences follow specific patterns, some of which have been documented empirically,[4]

[2]For a recent example of five elicitation methods and reference to such results, see Crosetto and Filippin (2015). As in previous experimental studies on the topic, they also find that the estimated risk aversion parameters vary greatly across tasks.

[3]Anecdotally, we would like to refer to the case of a referee stating and an editor agreeing that "to elicit one's risk parameter from a single choice is not problematic, whereas to obtain it from many decisions generally leads to inconsistencies".

[4]For example, *regression to the mean* has been found to affect repeated choices in the same task by García-Gallego et al. (2011). Furthermore, Lévy-Garboua et al. (2012) found a significantly higher elicited risk aversion in sequential than in simultaneous treatment, in decreasing and random than in increasing treatment, in high than in low-payoff condition. Their findings suggest that subjects use available information that has no value for normative theories. Cox et al. (2014) have rationalized some of these findings by showing the role of the payment mechanism in these distortions. Indeed, they find that random-lottery incentive mechanisms – as those usually employed in risk-elicitation tasks – may decrease the proportion of risky choices in the population, if compared to a one-task design. This could explain why significantly more risk aversion emerges under multiple-task than under

and even conform to the well-known paradigm of preference imprecision.[5]

Thus, even when choices by the same subject in the same task over different trials are different, attitudes elicited in similar tasks should be related to some extent, even through correlation of the ranking that subjects received by their choices in the overall population. If this *desideratum* is satisfied, then eliciting risk attitudes as an explanatory variable of behavior in another task can be considered a meaningful strategy. On the contrary, if any arbitrarily small change of the context produces different attitude elicitations that are not systematically related across tasks, we risk failing to satisfactorily answer the question "*does any of what we are observing in the lab relate at all with what anyone (even the same subject) does outside the lab?*"

In this paper, we aim at shedding light on the reliability of *HL*, the method mainly used in the last decade to elicit risk attitudes across a wide array of contexts and environments. To achieve this goal, we compare it experimentally to another risk-elicitation method, *SG*, which is made by a series of four tasks that we think can help us in identifying risk-related attitudes disregarded by the implementation of *HL* alone. Using the type classification emerging from the choices made in *SG*, we want to see 1. whether the correlation between the risk-aversion orderings under the two elicitation procedures increases, and 2. whether any of these two monetary-incentivized mechanism is a good predictor of self-assessed risk attitudes (e.g. elicited through a hypothetical question about one's general willingness to take risks).

We report two rather exceptionally positive findings which can contribute to a literature full of negative or contrasting results. First, we find evidence of some external validity of these two mutually uncorrelated risk-attitude elicitation methods – *HL* and *SG* – as predictors of self-reported risk attitudes in general human domains. Second, and more importantly, we show that sufficiently similar incentivized mechanisms elicit correlated decisions in terms of monetary risk aversion *only if* other risk-related attitudes are disentangled. Considered together, our results indicate that, whereas both *HL* and *SG* are reasonably good predictors of self-assessed risk attitudes, the use of a more complete description of subjects' risk attitudes is helpful when stating the ability of each test to predict self-reported attitudes.

The rest of the paper is structured as follows. In Section 4.2 we review the literature on risk-aversion elicitation, and show more in depth the specific issues on which our study aims at contributing. Section 4.3 presents our experimental design. In Section 4.4 specific behavioral hypotheses are introduced. Section 4.5 analyzes the experimental results, which are discussed in the concluding section.

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one-task elicitation methods.

[5] See Butler and Loomes (2007).

2 Literature review

Assessing and measuring individuals' risk preferences is a fundamental issue for economic analysis and policy prescriptions (Charness et al., 2013). As a result, economists and other social scientists have developed a wide variety of experimental methodologies to elicit individual risk attitudes. Risk preferences have been indirectly derived from *first-price sealed bid auctions* (e.g. Cox et al., 1982, 1985, 1988), or elicited as *lottery certainty equivalents* (Becker et al., 1964). Individual degrees of risk aversion have also been experimentally measured through asking subjects to input a value for one of the outcomes of a lottery that would make them indifferent with respect to another proposed lottery (the so-called *trade-off method* by Wakker and Deneffe, 1996).

Survey methods have also been employed, where subjects are asked to *self-report* their risk preferences through a series of *hypothetical questions* concerning a general willingness to take risks (see, e.g., Dohmen et al. (2011), for a representative sample of roughly 22,000 German subjects) or a specific willingness to participate in a lottery (see, e.g., Attanasi et al. (2013), for a sample of about 10,000 Italian subjects over five consecutive years).

Today, the most common and widespread procedure used by economists to measure risk preferences in the laboratory is to ask subjects to choose one lottery (*single decision*) among a panel of lotteries. These lotteries can either entail a single choice among a set of predetermined prospects, presented in an abstract way (Eckel and Grossman, 2008), or can be framed as an investment decision (Charness and Gneezy, 2010), or still can be presented by means of a visual task, without making any explicit reference to probabilities (Lejuez et al., 2002; Crosetto and Filippin, 2013).

As an extension of the previous methods, subjects were asked to make *multiple decisions* between pairs or panels of risky lotteries. This is the case under investigation in this paper. As a matter of fact, both Holt and Laury (2002) and Sabater-Grande and Georgantzis (2002) use this last method in order to elicit risk aversion. Holt and Laury (2002) – and follow-up papers[6] – is the most well-known example of a "multiple price list design" which, according to Cox and Harrison (2008), was first used in Miller et al. (1969). The risk-elicitation procedure used in Sabater-Grande and Georgantzis (2002) is a slightly revised version of the "ternary lotteries approach" (see, e.g., Roth and Malouf, 1979).

In this paper two risk-elicitation methods are proposed in a within-subject design. Besides the original version, the multiple pairwise comparison in *HL* has been usually implemented with two non-mutually-exclusive variants. The first one – "switching multiple price list" – was introduced by Harrison et al. (2005) and studied at length by Andersen et al. (2006): Monotonicity is

[6] See Harrison et al. (2005) and Holt and Laury (2005): the former demonstrated and the latter confirmed the possibility of order effects in Holt and Laury (2002) original design by scaling up real payments by 10 or 20 times.

enforced, i.e. the subject is asked to pick the switch point from one lottery to the other and non-switch choices are filled automatically. The second one concerns doubling the number of outcome probabilities for which the two lotteries are compared, in order to allow the subject to make choices from refined options: This second variant, together with enforced monotonicity, has been implemented by Attanasi et al. (2014a), where *HL* is made of 20 lottery pairs instead of 10. The second risk-elicitation method is the same as the one used in Sabater-Grande and Georgantzis (2002) and follow-up papers.[7]

As anticipated in the Introduction, our choice of analyzing and comparing two alternative methods of measuring risk preferences is partly due to a puzzling result in experimental economics: The degree of risk aversion shown by subjects in the laboratory is often varying across different elicitation techniques (see, e.g., Isaac and James, 2000; Dave et al., 2010), although some correlations are found among monetary-incentivized instruments and survey-based methods (see, e.g., Vieider et al., 2015).

In recent years, a growing literature is investigating different risk-elicitation methods, comparing their effectiveness in eliciting risk attitudes in non-interactive settings. Harrison and Rutström (2008) review experimental evidence on risk aversion in controlled laboratory experiments. The authors examine the experimental design of several procedures that allow direct estimation of risk preferences from subjects' choices, as well as the way to draw inference about laboratory behavior. Furthermore, they provide an investigation on how the data generated by these procedures should be analyzed. In the same line, Charness et al. (2013) provide a discussion of a series of prevailing methods for eliciting risk preferences. They outline the strengths and weaknesses of each of these methods. In particular, they highlight that choosing which method to utilize is largely dependent on the question the researcher wants to answer. Both these reviews of risk-elicitation methods include a thorough discussion of *HL*.

Among experimental studies that compare *HL* with other risk-elicitation methods, two are relevant for our paper. Charness and Viceisza (2015) compare two incentivized risk-elicitation methods in a between-subject design, namely *HL*, and the modified version of the Gneezy-Potters method as presented in Charness and Gneezy (2010). In both treatments, subjects also self-report their risk attitude by answering a hypothetical question similar to the one in Dohmen et al. (2011). The experiment was run in rural Senegal, with the aim of providing guidance to experimenters wishing to use risk-elicitation mechanisms in the rural developing world. Crosetto and Filippin (2015) compare five incentivized risk-elicitation methods in a between-subject design: *HL*, Eckel and Grossman (2008), Charness and Gneezy (2010),Lejuez et al. (2002), and Crosetto and Filippin (2013). All experimental sessions being run in Jena (Germany), they find that subjects' estimated risk aversion

[7]See Georgantzís and Navarro-Martínez (2010), and García-Gallego et al. (2011).

parameters vary greatly across tasks. Our work is positioned exactly in this branch of the literature.

Using original data from a homogeneous population of Italian subjects, we provide an experimental comparison of *HL* with another incentivized risk-elicitation method (*SG*), and a self-assessment measure of risk attitude (a hypothetical question similar to the one in Dohmen et al., 2011). Differently from the previous literature, this comparison is made through a *within-subject* design: each subject in our experiment goes through the three risk-elicitation procedures, and we control for other effects. Furthermore, we compare two *multiple-decision* methods, while in previous studies *HL* has only been compared to single-decision methods. In fact, we think that coupling *HL* with another multiple-decision mechanism could help shed more light on the reliability of the former.

As underlined above, *HL* is the most widely used risk-elicitation method in experimental economic analyses in the last ten years: When risk aversion is considered as an explanatory variable for subject's behavior in an individual or strategic decision setting, a preliminary test of risk aversion (preliminary with respect to the main decision setting where subjects' behavior should be analyzed) is needed. In this regard, *HL* has a clear advantage with respect to many other risk-elicitation methods: especially when enforcing monotonicity – as it is more frequently the case in economic experiments – it allows to completely describe a subject's risk attitude through just one subject's choice.

It is well known that this requires assuming that the subject is a von Neumann-Morgenstern expected utility maximizer. Many papers have shown that this assumption is questionable (see Wakker (2010) for a review), although other models (e.g., prospect theory) do not seem to have significantly higher explanatory power than expected utility (Harrison and Rutström, 2009). However, the goal of our exercise is not to test the expected utility assumption in *HL*. Rather, we are interested in other risk-related attitudes that are not taken into account when analyzing *HL* data, since with just one choice per subject, by construction, attention is restricted to the curvature of the uniparametric (Bernoullian) utility function.[8] Therefore, other relevant risk-related attitudes may be disregarded.

The intuition behind our exercise is that the series of four tasks that constitute *SG* can help us in identifying some of these further risk-related attitudes. This is the main reason why we focus on the comparison between *HL* and *SG*. Using the type classification emerging from the choices made in *SG*, we want to see whether the correlation between the risk-aversion order-

[8]Notice that this problem would emerge also in the absence of enforced monotonicity. In fact, when *HL* is performed – as in the original paper – by asking subjects to make a choice between the two options for each of the 10 outcome probabilities, a subject who switches from one lottery to the other more than once as the probability of the best outcome increases, is still considered as if he/she has made just one choice (one switch). This is done by assigning to this subject as switch point from one lottery to the other the one corresponding to the number of safe choices the subject has made.

ings under the two elicitation procedures increases. Furthermore, and more importantly, we want to check whether, by disentangling subjects according to these further attitudes, the correlation between a subject's self-reported sensitivity to risk and the monetary-incentivized choice made respectively in *HL* and in *SG* is higher. A positive answer to the last question – that is what we actually found in this paper – should help explain why experimental economists (rather than psychologists) usually do not rely on self-reported measures of risk: The hypothetical questions used to let subjects self-assess their level of risk attitude might hide risk-related motivations other than monetary risk aversion, i.e., the curvature of the uniparametric expected utility function.

3 Experimental design

Participants were 62 undergraduate students in Economics, recruited at Bocconi University in Milan on October 2013. Each subject could only participate in one session: Two sessions were run with 31 subjects each in a computerized room of Bocconi University, with subjects being seated at spaced intervals.

In each session, subjects faced two risk-elicitation tasks (*HL* and *SG*) on a within-subject base. In the two sessions, the two tasks were shown in reverse order. Only one of the two tasks was used to determine subjects' final earnings. The choice of the task to be paid was made in a random way, by flipping a coin. Payment was preceded by a questionnaire, which included a question about self-assessment of risk attitude.

Average earnings were €15.90, including a €3.00 show-up fee. The average duration of a session was 45 minutes, including instructions and payment. The experiment was programmed and implemented using the z-Tree software (Fischbacher, 2007).

3.1 Task 1 (*HL*)

The first task was *HL* with the two variants of enforced monotonicity and 20 (rather than 10) lottery pairs, and set of lottery payoffs as in Attanasi et al. (2014a). See Figure A1 in the Appendix.

3.1.1 Features of the task

- Subjects were presented with a battery of 19 pairs of two-outcome lotteries, numbered from line $L1$ to line $L19$, and a last (empty) line $L20$ (bottom line of Figure A1).

- Each pair described two lotteries called A and B.

- Each lottery presented two positive monetary outcomes and their associated probabilities.

- The two monetary outcomes of each lottery were kept constant: For each line $L1$–$L19$, lottery A always had the two outcomes, $\bar{x}_A =$€ 12.00, $\underline{x}_A =$€ 10.00, and lottery B always had the two outcomes, $\bar{x}_B =$€ 22.00, $\underline{x}_B =$€ 0.50.

- Within each pair, $\bar{x}_A$ and $\bar{x}_B$ were attached the same probability p, with p increasing – gradually and monotonically – when moving from the top ($L1$) to the bottom ($L19$) of the battery of lottery pairs.

- Probabilities were framed by means of an urn that contained 20 tickets, numbered from 1 to 20, the number of tickets associated to the highest of the two outcomes, $\bar{x}_k$, being independent of the lottery ($k = A, B$) and varying with the line. In particular, in $L1$ the highest outcome was assigned ticket no. 1; in $L2$, tickets no. 1 and 2; ... ; in $L19$, all tickets but no. 20. Hence, in the light of a final random draw of a ticket from the urn, the probabilities of $\bar{x}_k$ and of $\underline{x}_k$ were respectively: 1/20 and 19/20 in $L1$; 2/20 and 18/20 in $L2$; ... ; 19/20 and 1/20 in $L19$.

3.1.2 What subjects were asked to do

Given the battery of lotteries, each subject was asked to choose the *switch line*, i.e. the pair of lotteries starting from which he/she preferred lottery B to lottery A. Thus, for all pairs of lotteries above the switch line, a subject preferred lottery A to lottery B, while starting from the pair on the switch line and for all the pairs below, he/she preferred lottery B to lottery A. A subject preferring lottery A to lottery B for all the 19 pairs, selected the last (empty) line $L20$.

3.1.3 Determination of the subject's earnings

Suppose that task 1 was randomly selected (by flipping a coin) at the end of the experiment to determine subjects' earnings. Then, for each subject the computer would randomly select a pair of lotteries, i.e. one of the 19 lines of the battery of lotteries. The *randomly-selected line* indicated the number of tickets assigned to the highest outcome, hence the probability associated to the two outcomes of both lottery A and lottery B.

If a subject's switch line was below the randomly-selected line, then the two lottery outcomes for which that subject played were $\bar{x}_A =$€ 12.00 and $\underline{x}_A =$€ 10.00; otherwise, the two lottery outcomes for which that subject played were $\bar{x}_B =$€ 22.00 and $\underline{x}_B =$€ 0.50.

Then, an experimenter randomly drew one of the 20 tickets contained in the urn (physical implementation).[9] The ticket drawn by the experimenter was used to determine whether each subject earned the higher or the lower outcome of the chosen lottery in the randomly-selected line.

3.2 Task 2 (*SG*)

The second task was *SG* as implemented by – among other studies – Georgantzís and Navarro-Martínez (2010), García Gallego et al. (2012) and García-Gallego et al. (2011).[10] See Figure A2 in the Appendix.

3.2.1 Features of the task

- Subjects faced four decision problems. Each problem concerned a panel of 10 two-outcome lotteries described in three rows. Each lottery had a positive outcome X and a null outcome.
- The first row presented, for each of the 10 lotteries, the probability p assigned to the positive outcome X.
- The second row presented, for each of the 10 lotteries, the positive outcome X.
- The third row consisted of 10 empty cells, for each subject to indicate with a cross the preferred lottery in each of the four panels.
- Across each panel of lotteries, neither X nor p were kept constant. However, p was the same for the same column of each panel: Probabilities were framed by means of an urn that contained 10 tickets, numbered from 1 to 10, the number of tickets associated to X decreasing with the column number of each panel of lotteries. In particular, in the first column (leftmost lottery), all tickets were associated to X; in the second column, all tickets but no. 10 were associated to X; ...; in the tenth column (rightmost lottery), only ticket no. 1 was associated to X. Hence, in the light of a final random draw of a ticket from the urn, for each panel, the leftmost lottery represented the safest option ($p = 100\%$) with the lowest positive outcome, while the rightmost lottery represented the riskiest option ($p = 10\%$) with the highest positive outcome. Moving from the left side to the right side in a panel, the lotteries were constructed in order to compensate riskier options with

[9] See Section 5.3 of Attanasi et al. (2014b) for the pros and cons of physical vs. computerized instruments when generating realizations of random processes in laboratory experiments on decision under uncertainty.

[10] In Sabater-Grande and Georgantzis (2002) the payoffs are expressed in pesetas, since the experimental sessions were run in Spain before the introduction of the Euro as official currency in the European Union. In the follow-up studies cited above, still run in Spain, the payoffs are equivalently expressed in Euros.

increases in the expected payoff pX. Thus, the positive outcome X increases with the column number of each panel of lotteries.

- Formally, each continuum of lotteries was defined by the pair (c, t) corresponding, respectively, to the certain payoff c above which the expected payoff of the lottery L was increased by t >0, times the probability of earning nothing, i.e.

$$E(L) = pX = c + (1-p)t \quad \Rightarrow \quad X(p) = \frac{c + (1-p)t}{p} \; ,$$

  where t is a panel-specific risk premium, which generates an increase in the lotteries' expected values as one moves from safer option (left side of Figure A2) to riskier (right side of Figure A2) options within the same panel.

- In particular, the four panels of lotteries were constructed using $c =$ €1 in all panels and $t = 0.1$ for panel 1, $t = 1$ for panel 2, $t = 5$ for panel 3, and $t = 10$ for panel 4. Hence, the above formula shows that in the first column (leftmost lottery) the certain positive outcome was the same for each panel ($X(100\%) = c =$ €1), while in all remaining columns the certain positive outcome was increasing in the panel number, being maximum in the last column (rightmost lottery), with $X(10\%)$ being €10.90 for panel 1, €19.00 for panel 2, €50 for panel 3, and €100 for panel 4.

3.2.2 What subjects were asked to do

For each panel of lotteries, each subject was asked to choose one of the 10 lotteries (X, p) that implied a probability p of earning X, else nothing. Hence, for each of the four panels, a subject was asked to put a cross in the empty cell corresponding to his/her preferred lottery among the 10 available lotteries (10 columns).

3.2.3 Determination of the subject's earnings

Suppose that task 2 was randomly selected (by flipping a coin) at the end of the experiment to determine subjects' earnings. Then, for each subject the computer would randomly select one of the four panels of lotteries.

For the randomly-selected panel of lotteries, the cross put by a subject in the empty cell corresponding to his/her preferred lottery indicated the positive outcome of the lottery (X) and the number of tickets assigned to this outcome (p).

Then, an experimenter randomly drew one of the 10 tickets contained in the urn (physical implementation). The ticket drawn by the experimenter was used to determine whether each subject earned the positive or the null outcome of his/her preferred lottery in the randomly-selected panel.

3.3 Questionnaire

A questionnaire about some idiosyncratic features has been submitted at the end of the experiment. Each subject was asked his/her gender, age, year and field of study, previous attendance of an advanced course in Decision/Game Theory, and a question about self-assessment of general attitude towards risk, similar to the one used in Dohmen et al. (2011). In particular, the question was posed using the same wording of Bernasconi et al. (2014), which also run their experiments with Italian subjects: "In a scale from 1 to 10, how would you rate your attitude towards risk: are you a person always avoiding risk or do you love risk-taking behavior?", where 1 was associated with the statement "I always choose the safest option and try to avoid any possible risk" and 10 referred to "I love risk and I always choose the more risky alternative".

4 Behavioral Hypotheses

Each task is mainly targeted to elicit a subject's degree of (monetary) risk aversion, through a different method. However, task 1 (*HL*) being characterized by less "flexibility" in the subject's available choices with respect to task 2 (*SG*), the latter can be used to disclose and disentangle other risk-related motivations. **In fact, while in this variant of *HL* a subject is asked to choose the line (pair of lotteries) starting from which she preferred lottery B to lottery A (with *the same* associated probabilities),** in each panel of lotteries in *SG* the subject is asked to pick the preferred outcome-probability combination, with both the positive outcome and its associated probability being *different* for each lottery. With this in mind, our **first aim** is to use subject's four choices in *SG* to disentangle his/her risk-related motivations behind the unique choice (switch line) in *HL*.

A Constant Relative Risk Averse (*CRRA* hereafter) utility function of the form $U(x) = \frac{x^{1-r}}{1-r}$ is assumed to elicit a subject's (monetary) risk attitude in both *HL* and *SG*, implying risk aversion for $r > 0$, risk neutrality for $r = 0$, and risk proneness for $r < 0$.

In *HL*, given the structure of the battery of lotteries (see Figure A1 in the Appendix), the higher the number of the switch line (pairwise comparison at which a subject chooses to switch from lottery A to lottery B), the higher his/her disclosed degree r of relative risk aversion (see Table A1 in the Appendix). In particular: a switch line from $L1$ to $L9$ would reveal risk proneness (the smaller the number of the switch line, the higher $|r|$, the degree of risk proneness). A risk-neutral subject would indicate $L10$ as switch line; a switch line from $L11$ to $L19$ would reveal risk aversion (the greater the number of the switch line, the higher r, the degree of risk aversion).

In the original version of *HL*, subjects had to choose the preferred lottery between A and B in each of the 10 lines of the battery, giving rise to the possibility of inconsistent behavior at the individual level.[11] In our study, due to the *enforced monotonicity* feature of the implemented variant of *HL*, consistency has been imposed. Picking the switching line directly provided an interval estimate of the subjects' coefficient r of relative risk aversion. Moreover, *doubling the number of outcome probabilities* for which lotteries A and B are compared (20 lottery pairs instead of 10) allowed a more precise interval estimate of r, given the switching line.

As far as *SG* is concerned (see Figure A2 in the Appendix), an expected-utility maximizing subject with a *CRRA* utility function as introduced above would choose a lottery (X^*, p^*) with $p^* = \frac{cr}{t} + r$ in each of the four panel of lotteries. Hence, the chosen probability p^* of the positive outcome is monotonically decreasing in the subject's degree r of relative risk aversion. That is, safer choices in each panel (left side of each panel in Figure A2) are associated with a higher r (see Table A2 in the Appendix). In particular, all risk-neutral and risk-loving subjects should choose the lottery at the far right extreme of each panel in Figure A2 ($p = 0.1$ in Table A2). Furthermore, given that the panel-specific risk premium t increases by construction with the panel index, all *CRRA* subjects with a given r should not choose safer lotteries (weakly monotonic transitions) as they move from panel-1 lotteries to panel-4 lotteries. In terms of Table A2, moving to a panel with a higher index, *CRRA* subjects should choose in this panel a lottery not being on the left side of the lottery chosen in the previous panel.

SG has several advantages that are useful to our analysis. Firstly, the above-mentioned theoretical predictions also hold for other well-known utility functions like *CARA* (Constant Absolute Risk Aversion) or other functional forms for *CRRA*, different from the one for which the elicited r in Table A1 (for *HL*) and Table A2 (for *SG*) has been calculated. Secondly, *SG* exposes a subject to the same wide range of probabilities in each panel-wise comparison, and to a systematic spectrum of monetary rewards from € 1 (far left extreme of each panel) to the relatively high payoff of € 100 (far right extreme of the panel 4). Finally, the test offers a range of different returns to risk so that a highly-risk-averse subject might refuse to take too risky options when a higher return is at stake (e.g., he/she chooses $p = 0.4$ in panels 3 and 4), while he/she could be attracted by highly-risky prospects when returns are lower (e.g., he/she chooses $p = 0.1$ in panels 1 and 2). This is incoherent with the *CRRA* assumption, however it can disclose other interesting risk-related motivations, as we will see in the next section. Thus, unlike all uni-dimensional tests of monetary risk attitude, *SG* may be used to classify subjects not only according to their willingness to take monetary risks, but also with respect to their propensity to change their "objective function" across different risk-return combinations. This would help disentangle risk-

[11] As a matter of fact, individuals going back and forth in their choices could be considered inconsistent with a *CRRA* pattern: This happened for around 13% (7%) of subjects in the initial (final) low-payoff task of *HL*.

related motivations that might explain a subject's different choice in *HL*.

Our **second aim** is to check whether the self-reported assessment of risk preferences in the final questionnaire is an explanatory variable for the degree of risk aversion elicited in any of the two monetary-incentivized tasks of our experiment. Many field studies have shown that asking a general hypothetical question about the self-assessment of risk aversion is a simple procedure to estimate risk attitudes of subjects (see, among others, Guiso and Paiella, 2008). In particular, Dohmen et al. (2011) have shown that such questions are as effective as other common and much more complicated procedures used in laboratory experiments.

In this paper, we separately check whether the answers to the hypothetical question on the self-assessment of the degree of risk aversion relate with the subject's choices in *HL* and in *SG*. Notice that in the general hypothetical question proposed in our questionnaire, the higher the selected number in the 1-10 scale, the lower the subject's *self-assessed degree of risk-aversion*. Hence, this should correlate negatively with the number of the switching line in *HL* and positively with the probability chosen in each panel of *SG*.

Given the relevance of *HL* for current laboratory experiments on risk elicitation, we further focus on it: We use a subject's answers to the general hypothetical question on risk assessment to disentangle his/her risk-related motivations behind the choice in *HL*. Therefore, in the final part of the next section, both *SG* and the hypothetical question – together with the other questions on idiosyncratic features in the final questionnaire – were used as regressors in the analysis of behavior in *HL*.

5 Results

5.1 Aggregate analysis

We observe no significant effect of proposing *HL* before *SG* or showing them in reverse order. Thus, in the following we will pool data from the two treatments.

The distribution of individuals among their risk-related choices is quite close in the two tasks: 74% of subjects disclose risk aversion in *HL*, and 77% in *SG* (on average over the four panels) disclose risk aversion. However, this first check is made only at a between-subject level. We must also check whether, within-subject in the two tasks, the sign of the risk attitude does not change, i.e. if a subject showing risk aversion (proneness) in *HL* also shows risk aversion (proneness) in each of the four panels of *SG*.

Table 1 reports the conditions to be satisfied to pass such test, by summarizing the information reported in Tables A1–A2 in the Appendix (we indicate with SG_i the choice made in panel i of *SG*, with panel number $i =$ 1,2,3,4). Indeed, a subject disclosing risk aversion because switching after $L10$ in *HL* (46/62, 74% of the sample), should choose a lottery with $p \geq 0.4$

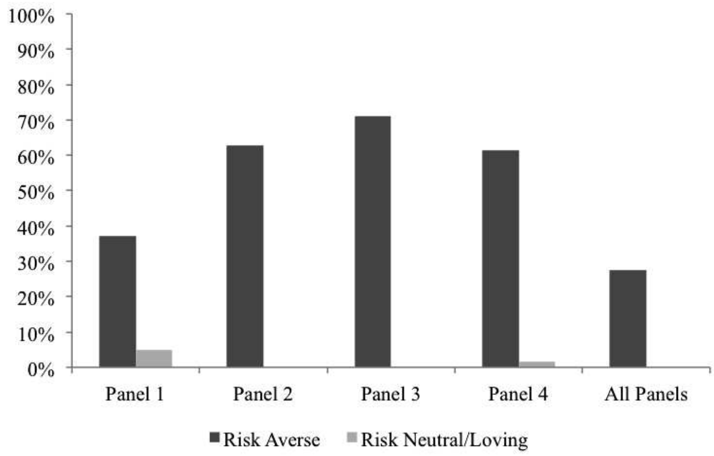
in panel 1, and a lottery with $p \geq 0.2$ in the other three panels of *SG*. All other subjects should choose a lottery with $p \leq 0.3$ in panel 1, and a lottery with $p = 0.1$ in the other three panels of *SG*.

Table 1: Threshold levels for coherent choices according to the sign of r

	Switch Line	*Chosen Probability*	
	HL	SG_1	SG_2-SG_4
Risk averse ($r > 0.038$)	*L*11-*L*20	$0.4 \leq p \leq 1$	$0.2 \leq p \leq 1$
Risk loving and risk neutral ($r < 0.038$)	*L*1-*L*10	$p \leq 0.3$	$p = 0.1$

Figure 1 reports the percentage of subjects disclosing risk aversion according to the elicited r in *HL*, which also show a positive r in each of the four panels of *SG*, and in all the four panels considered together. We can see that, apart from panel 1 – where the payoff scale is much smaller than in *HL*[12] – the majority of *HL*-risk-averse subjects (always more than 60% in each of the three last panels) also show a risk-averse behavior in *SG*. Conversely, among the few (16/62, 26% of the sample) *HL*-risk-neutral and *HL*-risk-loving subjects, almost none discloses the same sign of risk attitude in any panel of *SG*. For example, in panels 2 and 3, they all make risk-averse choices. All these findings are summarized in Result 1.

Figure 1: Subjects showing the same sign of risk attitude in *HL* and *SG*



Result 1. *The majority of subjects showing risk aversion in HL also show risk aversion in the four panels of SG. Risk-neutral and risk-loving subjects according to HL disclose risk aversion in the four panels of SG.*

We now check whether the ordering of subjects' risk preferences does not vary too much from one task to another.

[12] Indeed, 50% of all subjects (31/62) choose a lottery with $p \geq 0.4$ in panel 1, thereby disclosing risk neutrality or proneness.

The controls for SG work as they should: A significant positive correlation (at least 50%, always significant at the 1% level) is found among the ordering of any randomly-chosen pair of panels of SG. Furthermore, the level of accepted risk decreases (on average across all subjects) with the panel number, coherently with the assumption of $CRRA$ (moving from panel 1 to panel 4 we have increasing stakes for the same number of tickets assigned to the positive outcome).

We perform the Spearman rank correlation test among choices made in each of the four panels in *SG*, and choices in *HL*, and between the latter and a variable representing the average choice in the four panels (SG_{Avg}). Results are reported in Table 2.

Recall that: In *HL*, the larger the number of the switch line, the *smaller* the number of tickets assigned at this line to the lower of the two outcomes (see Figure A1 in the Appendix), and the *higher* the subject's disclosed degree of risk aversion (see Table A1 in the Appendix); in each panel of *SG*, more in the left the chosen lottery is, the *smaller* the number of tickets assigned to the null outcome (see Figure A2 in the Appendix), and the *higher* the subject's disclosed degree of risk aversion (see Table A2 in the Appendix). Therefore, from now on, when analyzing results for *HL*, we consider as index the *number of tickets assigned in the switch line to the lower outcome*; when analyzing results for each panel of *SG*, we consider as index the *number of tickets assigned in the chosen lottery to the null outcome.* Hence, a positive correlation between these two indexes would mirror the positive correlation between disclosed risk attitudes in the two tasks.

Table 2: Rank correlations between self-assessed risk and average choices in the two tasks, by panel.

	$HL - SG_1$	$HL - SG_2$	$HL - SG_3$	$HL - SG_4$	$HL - SG_{Avg}$
Spearman's rho	0.11	0.04	0.11	0.04	0.13
p-value	0.39	0.78	0.37	0.76	0.31

Rank correlations in Table 2 lead to the following:

Result 2. *A positive but small and not significant correlation is found between subjects' risk ordering in HL and their risk ordering in any of the four panels of SG.*

Thus, different risk-elicitation instruments seem to lead to different orderings of the relative risk aversion coefficient r, if Expected Utility is assumed for all subjects. Note that this result still holds when conditioning on age, gender, and for past attendance of a course in decision/game theory. However, a positive and quite surprising finding emerges if looking at subjects' self-reported risk through the hypothetical question in the final questionnaire.

In particular, we make use of the self-assessed risk variable in order to check on the rank correlation between this subjective measure and the risk-

related choices made by the subjects in the two tasks. Recall that in the question about self-assessment of general risk attitude, the *smaller* (closer to 1) the chosen number, the *higher* the self-assessed general aversion to risk. Hence, a positive correlation between this choice and the above defined index in a risk-elicitation task (*HL* or *SG*) would mirror the positive correlation between self-assessment of risk and the disclosed monetary risk attitude in the task.
This check leads to the following:

Result 3. *Significant positive correlation is found between subjects' ordering expressed by self-reported risk and the risk ordering in HL (rho = 0.47, p-value = 0.000). Significant positive correlation is also found between the ordering expressed by self-reported risk and the risk ordering in SG (rho = 0.48, p-value = 0.000).*

As can be noticed, the two correlation coefficients are very close. Both methods seem to be able to account for a good amount of inter-individual differences in general aversion to risk, with similarly high explanatory power.

From these preliminary results, three questions arise:

1) *Why are the rankings produced by the two methods not correlated while instead each of them is correlated with self-assessed general aversion to risk?*

2) *Why are the correlation coefficients of each method with self-assessed general aversion to risk smaller than 50%?*

3) *Why are the correlation coefficients of each method with self-assessed general aversion to risk so close?*

The analysis in the next subsection, which account for both idiosyncratic features (elicited in the questionnaire) and other risk-related motivations (as emerging from choices in the four panels of *SG*) is meant to answer the above questions. The reliability of *HL* as instrument for risk-aversion elicitation crucially depends on the answers to the previous questions.

5.2 Type classification analysis

Results 1–3 above lead us to think that there can be other subjects' features and motivations (other than monetary risk aversion) orienting subjects' choices in each of the two analyzed instruments. If we disentangle subjects according to these motivations, we should find individuals who better disclose their self-reported risk aversion in *HL* and others who better disclose it in *SG*.

First, we check whether idiosyncratic features (gender, age, education, etc.), elicited through the final questionnaire, are of some help in providing a coherent explanation for the previous findings. Furthermore, since *HL* only requires one choice for each subject, while *SG* requires four choices for each subject, we use this second instrument in order to disentangle risk-related motivations.

5.2.1 Individual characteristics

We run again the Spearman rank correlation tests between self-assessed risk and individuals' choice in both *HL* and the average choices in *SG* by sub-groups of population.

First of all, with respect to **gender** we find that females show a significantly higher correlation between self-assessed risk and risk behavior in both *HL* and SG_{Avg}. The two correlation coefficients are again of the same magnitude: *rho* = 0.60 for *HL* (*p-value* = 0.038), *rho* = 0.61 for *SG* (*p-value* = 0.035). The correlation coefficients for the sub-group of males, though significant, are lower than those obtained for the whole sample: *rho* = 0.31 for *HL* (*p-value* = 0.050), *rho* = 0.42 for *SG* (*p-value* = 0.006).

Another interesting issue is whether having attended an advanced course in decision or game theory could strengthen the correspondence between subjects' self-assessed risk and their actual risk-related choices in the two tasks. Our auxiliary assumption is that such attendance should indicate some **background in mathematically-related disciplines** (recall that our subjects are undergraduate students in Economics). The usual test reveals that the previous attendance of a decision/game theory course increases the correlation between self-reported risk and average choice in *SG*, while the opposite effect is found with regards to *HL* (see Table 3).

Table 3: Rank correlations between self-assessed risk and the two tasks, disentangled by gender and backgroungd in decision/game theory

	Female	***Male***
Self-assess and *HL*	0.61***	0.31*
Self-assess and SG_{Avg}	0.60**	0.42***
	Game Theory	***No Game Theory***
Self-assess and *HL*	0.43**	0.52***
Self-assess and SG_{Avg}	0.54***	0.37*

Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The former result could be explained by the higher level of complexity of *SG* – where both probability and outcome are different for each lottery in each of the four panels – with respect to *HL*, where the two pairs of outcomes are fixed for all pairwise comparisons. Thus, having some background in mathematically-related disciplines could be helpful in understanding a risk-elicitation task (in our case, *SG*), although Brañas-Garza et al. (2008) found no such effect across several risk-elicitation tasks.

Our interpretation is partially supported by a correlation coefficient (between self-assessed risk and the instrument) increasing in the **years of study at the university** for undergraduate students (from first to third year), if considering either SG_{Avg} or *HL* as risk-elicitation instrument (see Table 4). Notice that, although quite high, few correlations are statistically significant, due to few observations in each subset of subjects.

Table 4: Rank correlations between self-assessed risk and the two tasks, disentangled by the years of study at the university

	First		**Second**		**Third**		**Fourth**		**Fifth**	
	rho	*p-value*	*rho*	*p-value*	*rho*	*p-value*	*rho*	*p-value*	*rho*	*p-value*
Self-assess and SG_{Avg}	0.30	0.160	0.59	0.070	0.62	0.055	0.53	0.140	-0.01	0.980
Self-assess and HL	0.24	0.270	0.79	0.006	0.67	0.030	0.08	0.840	0.57	0.140

5.2.2 Risk-related motivations

A further step is to consider the possibility that there are *several* risk-related motivations that drive subjects' choices among lotteries in *SG*. With this in mind, we split the sample into three categories, according to the three main patterns of choices a subject can show in the four panels of *SG*.

The baseline category is the one comprising subjects whose behavioral pattern across panels is coherent with a Constant Relative Risk Aversion utility function (**CRRA-coherent** subjects). In our sample, subjects showing such compatibility are 14/62: They make *weakly-increasing choices* (in terms of risk-taking) in the four panels. For example, a subject belonging to this category select a number of tickets assigned to a positive outcome of 7/10 in panel 1, of 6/10 in panel 2, of 6/10 in panel 3, and of 2/10 in panel 4. Due to the discreteness of the decision settings, we include in this group also subjects who always made the same choice in the four panels: Although, as we will see below, they could reasonably belong to the other two categories, their behavior do not show incoherence with *CRRA*.

The second category includes subjects with *weakly-decreasing choices* (in terms or risk) in the four panels, hence incoherent with expected-utility maximization. In our sample, subjects showing this behavior are 17/62. We call them **Aspiration-level** subjects. Indeed, it is well known in the literature (Camerer et al., 1997; Diecidue and Van De Ven, 2008) that the concept of *aspiration level* is related to the subject's willingness to reach a particular outcome. In the paper by Camerer et al. (1997) the idea of aspiration level is explained through the cab drivers example: Cab drivers are willing to earn a daily target return, so that they adjust this behavior in order to achieve their goal. Other examples have been proposed in the literature such as farmers who want to prevent themselves from falling below the subsistence level (Lopes, 1987) or investors with the desired target rate of returns to achieve (Payne et al., 1980). In our framework, the idea of aspiration level could be explained by the willingness of our subjects to earn "around a given positive amount". Given the structure of the four panels in *SG*, the risk that one should take to get the "same" positive amount is smaller (the number of winning tickets is higher) the higher the panel number. For example, suppose that a subject wants to earn around €8 in each of the four panels. This is consistent with selecting a number of tickets assigned to this outcome equal to 1/10 in panel 1, equal to 2/10 in panel 2, equal to 4/10 in panel 3, and equal to 6/10 in panel 4.

The residual category is composed by individuals who show non-monotonic choices in the four panels: They "move right and left" across the four panels. We call them **Non-monotonic** subjects. These subjects might interpret the four panels in *SG* as a *portfolio of contingent assets* (indeed, only one of the four panels is randomly selected for payment), where they can compensate the greater risk taken in some state of the world (e.g., in panel 1 and in panel 3) by choosing less risky assets in the complementary states (e.g., in panel 2 and in panel 4). In our sample, subjects showing this behavior are 31/62.

Both Aspiration-level and Non-monotonic can be viewed as additional risk-related motivations (additional with respect to *CRRA*). Therefore, two behavioral hypotheses can be drawn about behavior in *SG*:

H1) Aspiration-level vs. *CRRA*-coherent. Subjects with a given aspiration level pick a willing-to-win amount in the first panel of lotteries (the one with the lowest payoffs) and then decrease the probability of winning in the next panels, where payoffs are increased, in order to get around this amount. This ends up in a more risk-averse behavior in *SG* than the one disclosed in the same task by *CRRA*-coherent subjects. Indeed, the structure of *SG* contraints choices of an Aspiration-level subject in the four panels not to be too "far away" from one another, i.e. he/she chooses lotteries with close numbers of winning tickets in the four panels (e.g. earning around €5 requires choosing a lottery with 2/10, 3/10, 6/10 and 7/10 tickets assigned to the positive outcome respectively in panel 1, 2, 3 and 4 – see Figure A2 in the Appendix). This ends up in a lower variance of the expected values of the chosen lotteries in the four panels, with respect to *CRRA*-coherent subjects. The latter, given a degree of risk aversion r, when moving from panel i to panel $i+1$, are "free" to choose lotteries with higher expected values, i.e. with number of winning tickets in panel $i+1$ potentially much higher than in panel i (e.g. a *CRRA*-coherent subject with $r = 0.091$ would choose a lottery with 10/10, 2/10, 1/10 and 1/10 tickets assigned to the positive outcome respectively in panel 1, 2, 3 and 4 – see Table A2 in the Appendix).

H2) Non-monotonic vs. *CRRA*-coherent. **Subjects who exert non-monotonic behavior** among lottery panels in *SG* are more risk-averse than pure *CRRA*-coherent subjects. Indeed, moving "right and left" across the four panels introduces additional constrains to the set of lotteries a subject can choose in panel i given the choice made in the other three panels $j \neq i$. For example, a *CRRA*-coherent subject with $r > 0.1$ would choose a lottery with 10/10 winning tickets in panel 1 and with 1/10 winning tickets in panel 4. A Non-monotonic subject with the same r would risk more when stakes are smaller (e.g., by choosing 5/10 winning tickets in panel 1), compensating this riskier choice by risking less when stakes are bigger (e.g., by choosing 5/10 winning tickets in panel 4). This ultimately leads to a lower variance of the expected values of the chosen lotteries in the four panels, with respect to *CRRA*-coherent subjects.

In order to test H1 and H2 we look at the variance among the expected values in the four chosen lotteries in *SG*, for each subject and for each category of subjects. In this task, the variance for each subject is a measure of the dispersion of the four choices with respect to the mean choice.

We find that both Aspiration-level subjects and Non-monotonic subjects have a lower average variance across panels of lottery expected values (respectively, 4.62 and 6.98) with respect to *CRRA*-coherent subjects (9.50). Both these differences are significant at the 5% level.

As a further round of investigation we perform a Mann-Whitney test by categories on standard deviations of "chosen" expected values in the four panels. Taking *CRRA*-coherent subjects are reference category, we find that the rank of these standard deviations is significantly lower for both Aspiration-level subjects (*p-value*=0.008) and for Non-monotonic. subjects (*p-value*=0.000). All this is summarized in the following:

Result 4. *Both Aspiration-level and Non-monotonic subjects disclose in SG a more risk-averse behavior than CRRA-coherent subjects.*

Furthermore we check whether by disentangling the sample according to the three above categories, the correlation between disclosed orderings of risk behavior in the two instruments increases. To this goal, we run another rank correlation test, and we find that the coefficients are higher with respect to the whole sample but still not significant (see Table 5).

Table 5: Rank correlations among instruments (*HL* and SG_{Avg}), disentangled by category of subjects

	SG			
	Whole Sample	*CRRA*	*Aspiration*	*Non-monotonic*
HL	0.13	0.21	0.22	0.19

Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The following statement extends Result 2:

Result 5. *If we disentangle by different risk-related motivations, the rank correlation between risk orderings in HL and SG increases. However, the correlation is still not significant.*

Going back to Result 3, we can improve the analysis of the goodness of the two instruments in disclosing subjects' self-assessed general risk aversion, by running the usual Spearman correlation test on each of the above defined categories of risk-related motivations (see Table 6). Disentangling by risk-related motivation, we find that *HL* performs on average better than *SG* in disclosing a subject's self-assessed general risk aversion. However, while *CRRA*-coherent subjects show a greater rank correlation with self-reported risk in *HL* than in *SG*, the latter better captures self-assessed risk aversion of Non-monotonic subjects. None of the instruments is able to elicit the self-assessed general risk aversion of Aspiration-level subjects.

Table 6: Self-assessed risk, disentangled by category of subjects

	Self-assessed risk			
	Whole Sample	*CRRA*	*Aspiration*	*Non-monotonic*
HL	0.47***	0.80***	0.38	0.45**
SG	0.48***	0.39	0.17	0.66***

Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The following statement extends Result 3:

Result 6. *When focusing only on subjects whose behavior is coherent with CRRA within an expected utility framework, HL is able to capture 80% of differences in subjects' self-assessed general aversion to risk. SG better captures self-assessed differences for subjects whose behavior is not coherent with CRRA, when they show non-monotonic behavior – hence, additional demand for risk protection – in this task.*

Finally, we focus on the determinants of behavior in *HL*. We use the average choice among the four panels in *SG* and the hypothetical question – together with the other questions on idiosyncratic features in the final questionnaire – as regressors (see Table 7).

Table 7: Determinants of behavior in *HL* (OLS regression)

	CRRA	***Aspiration***	***Non-monotonic***	***Whole sample***
SG_{Avg}	–1.87*	–0.93	0.30	–0.42
Self-assessment	0.92	2.43**	–0.12	1.04***
Gender	1.16	–1.11	4.05*	0.05
Age	–0.60	–0.27	2.52**	–0.05
Years of study	1.00	0.07	–2.40*	0.05
Study	0.42	–0.59	0.28	0.61
Game Theory	1.00	2.91	–2.56*	–0.44
Constant	3.88	–16.77	–64.62***	–17.50**
Obs.	17	14	31	62

Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

First, the results in Table 7 show the strong relation between risk behavior in *HL* and self-assessed aversion to general risk: the latter has a highly-significant impact on risk-averse behavior in *HL*. Second, the regression analysis clarifies why *SG* is not a good predictor of risk behavior in *HL*: the two instruments lead to opposite behavior for *CRRA*-coherent subjects, this category being the one whose behavior is better predicted by *HL*.

Furthermore, Aspiration-level subjects' behavior in *HL* is driven by their self-reported general aversion to risk. The intuition is that the willingness to take general risks determines a switch line in *HL* that in turn mirrors the specific (expected) outcome these subjects wish to obtain.

Finally, the regression analysis show that idiosyncratic features have an effect on risk behavior in *HL* only for Non-monotonic subjects. The intuition is that the heterogeneity of possible Non-monotonic patterns in *SG* might hide the interplay of idiosyncratic features, that ultimately impact on behavior in *HL*.

We conclude with some technical remarks. As far as we noted that the t-statistics for the coefficients are only marginally significant but with an overall F strongly significant, we conducted analyses to check for the possibility of multicollinearity. What we found is that the cross-correlations are low except for the variables Age and Years of Study (high correlations between pairs of coefficients would have indicated possible multicollinearity problems). As a further round of investigation, we run multicollinearity tests and we looked at the condition number, that is actually high (60.712), as well as condition indexes. On the contrary, Variable Inflation Factors are small. The diagnostics widely disagree. This is neither a surprising finding nor a problem from the point of view of the results. In fact, even extreme multicollinearity (and this is not the case under consideration here) does not violate the OLS assumptions: OLS estimates are still unbiased and BLUE (Best Linear Unbiased Estimators). We actually tried many different specifications of our regression model on the same data set. None of these changes produced significant improvements, suggesting that multicollinearity is not a relevant problem to be considered here.[13]

The following statement summarizes the main findings about the determinants of behavior in *HL*:

Result 7. *Self-assessed risk appears to be a relevant determinant of risk-related choices in HL, especially for Aspiration-level subjects. For Non-monotonic subjects, choices in HL are not explained by either SG or self-assessed risk; they are rather driven by idiosyncratic features.*

6 Conclusion

In this paper, we deep delve into a well-established result of the literature on risk elicitation: Making use of different experimental methods leads to different results in elicited risk preferences among subjects. To this end, we compare two Multiple Price List Design methods, one based on a single-choice setting (*HL*) and the other on a multiple-choice one (*SG*).

As a first step, we make use of usual non-parametric statistical tools to check whether subjects facing our different tasks at least maintain the same ordering in their risk-related lottery choices. Apparently, the result confirms the common result of independence among instruments. As a matter of fact,

[13]To account for the ordered nature of our dependent variable, we have also estimated an Ordered Logit Model: the results are qualitatively unchanged and available upon request.

the rank correlation between the two instruments turns out to be negligible and not significant.

Our analysis goes beyond by making use of a self-assessed measure of subjects' risk preferences, to check whether our instruments are capable to measure differences in self-reported attitudes towards risk.

What we find is that for both risk-elicitation procedures, risk preferences disclosed by subjects' choices are significantly correlated with their self-reported risk. This result is even stronger when we run a by-group analysis on different idiosyncratic controls.

Furthermore, and more importantly, we check whether other subjects' risk-related motivations could explain the correlation between elicited risk behavior through monetary-incentivized methods and self-assessed risk.

Since a multiple-choice risk elicitation method is available (*SG*), we use it so as to disentangle subjects according to three risk-related behaviors: the baseline behavioral category comprising *CRRA*-coherent individuals, a group of *Aspiration-level* subjects, and a last category of *Non-monotonic* subjects.

What is found is that in *SG* both Aspiration-level and Non-monotonic subjects make on average less risky choices than *CRRA*-coherent subjects. This confirms the intuition that both these categories hide an additional risk-related motivation (additional with respect to the curvature of the uni-parametric utility function), that cannot be disentangled by only looking at behavior in *HL*.

It is not surprising that if we exclude the two above categories and we only focus on subjects whose behavior in *SG* is coherent with *CRRA*, *HL* is able to capture 80% of differences in subjects' self-assessed general aversion to risk. A regression analysis confirms that self-assessed risk is a relevant determinant of risk-related choices in *HL*.

This result is even more striking when considering that it was obtained in a within-subject design. Indeed, as (Crosetto and Filippin, 2015) notice, proposing several risky choices on a within-subject base is likely to induce some form of hedging across tasks by non-risk-averse subjects. This could determine a negative correlation across tasks. Therefore, the low correlation between the behavior in different tasks could in part be an artifact of the design. We have shown that once this motivation is set aside (i.e. only *CRRA*-coherent subjects are considered), despite no correlation between *HL* and *SG*, an extremely high correlation between the risk behavior in the former method and self-reported risk attitude emerges. Thus, the positive results by Vieider et al. (2015) might hold even stronger if we account for heterogeneity stemming from more complex behavioral patterns like aspiration levels and hedging.

This result is relevant for experimental economists who wish to account for their subjects' risk attitudes as a determinant of behavior, being *HL* the experimental method mainly used in the last decade to elicit risk attitudes in the laboratory and in the field.

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Appendix

Figure A1: Task 1, Variant of Holt and Laury (2002)

	LOTTERY A	LOTTERY B
L1	If the drawn ticket is no. **1**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **2** and **20**, you win ***10.00*** euros.	If the drawn ticket is no. **1**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **2** and **20**, you win ***0.50*** euros.
L2	If the drawn ticket is between **1** and **2**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **3** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **2**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **3** and **20**, you win ***0.50*** euros.
L3	If the drawn ticket is between **1** and **3**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **4** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **3**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **4** and **20**, you win ***0.50*** euros.
L4	If the drawn ticket is between **1** and **4**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **5** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **4**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **5** and **20**, you win ***0.50*** euros.
L5	If the drawn ticket is between **1** and **5**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **6** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **5**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **6** and **20**, you win ***0.50*** euros.
L6	If the drawn ticket is between **1** and **6**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **7** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **6**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **7** and **20**, you win ***0.50*** euros.
L7	If the drawn ticket is between **1** and **7**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **8** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **7**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **8** and **20**, you win ***0.50*** euros.
L8	If the drawn ticket is between **1** and **8**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **9** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **8**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **9** and **20**, you win ***0.50*** euros.
L9	If the drawn ticket is between **1** and **9**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **10** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **9**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **10** and **20**, you win ***0.50*** euros.
L10	If the drawn ticket is between **1** and **10**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **11** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **10**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **11** and **20**, you win ***0.50*** euros.
L11	If the drawn ticket is between **1** and **11**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **12** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **11**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **12** and **20**, you win ***0.50*** euros.
L12	If the drawn ticket is between **1** and **12**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **13** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **12**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **13** and **20**, you win ***0.50*** euros.
L13	If the drawn ticket is between **1** and **13**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **14** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **13**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **14** and **20**, you win ***0.50*** euros.
L14	If the drawn ticket is between **1** and **14**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **15** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **14**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **15** and **20**, you win ***0.50*** euros.
L15	If the drawn ticket is between **1** and **15**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **16** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **15**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **16** and **20**, you win ***0.50*** euros.
L16	If the drawn ticket is between **1** and **16**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **17** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **16**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **17** and **20**, you win ***0.50*** euros.
L17	If the drawn ticket is between **1** and **17**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **18** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **17**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **18** and **20**, you win ***0.50*** euros.
L18	If the drawn ticket is between **1** and **18**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **19** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **18**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **19** and **20**, you win ***0.50*** euros.
L19	If the drawn ticket is between **1** and **19**, you win ***12.00*** euros; otherwise, if the drawn ticket is no. **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **19**, you win ***22.00*** euros; otherwise, if the drawn ticket is no. **20**, you win ***0.50*** euros.

Figure A2: Task 2, Sabater-Grande and Georgantzis (2002)

PANEL 1

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.12**	**1.27**	**1.47**	**1.73**	**2.10**	**2.65**	**3.56**	**5.40**	**10.90**
I prefer										

PANEL 2

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.20**	**1.50**	**1.90**	**2.30**	**3**	**4**	**5.70**	**9**	**19**
I prefer										

PANEL 3

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.66**	**2.50**	**3.57**	**5**	**7**	**10**	**15**	**25**	**55**
I prefer										

PANEL 4

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**2.20**	**3.80**	**5.70**	**8.30**	**12**	**17.50**	**26.70**	**45**	**100**
I prefer										

Table A1: Elicited r for HL

Switch Line	Elicited Degree of Risk Aversion
$L1$	$-\infty < r \leq -2.863$
$L2$	$-2.863 \leq r \leq -2.010$
$L3$	$-2.010 \leq r \leq -1.512$
$L4$	$-1.512 \leq r \leq -1.156$
$L5$	$-1.156 \leq r \leq -0.878$
$L6$	$-0.878 \leq r \leq -0.648$
$L7$	$-0.648 \leq r \leq -0.450$
$L8$	$-0.450 \leq r \leq -0.273$
$L9$	$-0.273 \leq r \leq -0.112$
$L10$	$-0.112 \leq r \leq 0.038$
$L11$	$0.038 \leq r \leq 0.180$
$L12$	$0.180 \leq r \leq 0.317$
$L13$	$0.317 \leq r \leq 0.454$
$L14$	$0.454 \leq r \leq 0.592$
$L15$	$0.592 \leq r \leq 0.736$
$L16$	$0.736 \leq r \leq 0.891$
$L17$	$0.891 \leq r \leq 1.068$
$L18$	$1.068 \leq r \leq 1.287$
$L19$	$1.287 \leq r \leq 1.613$
$L20$	$1.613 \leq r < +\infty$

Table A2: Elicited r for SGG

Panel 1		Panel 2		Panel 3		Panel 4	
Chosen p	Elicited r	Chosen p	Elicited r	Chosen p	Elicited r	Chosen p	Elicited r
1	0.091	1	0.500	1	0.833	1	0.909
0.9	0.082	0.9	0.450	0.9	0.750	0.9	0.818
0.8	0.073	0.8	0.400	0.8	0.667	0.8	0.727
0.7	0.064	0.7	0.350	0.7	0.583	0.7	0.636
0.6	0.055	0.6	0.300	0.6	0.500	0.6	0.545
0.5	0.045	0.5	0.250	0.5	0.417	0.5	0.455
0.4	0.036	0.4	0.200	0.4	0.333	0.4	0.364
0.3	0.027	0.3	0.150	0.3	0.250	0.3	0.273
0.2	0.018	0.2	0.100	0.2	0.167	0.2	0.182
0.1	0.009	0.1	0.050	0.1	0.083	0.1	0.091

Instructions

Welcome and thank you for participating in this experimental session. By following the instructions you will earn an amount in Euros that will be paid in cash at the end of the session.
Your earnings will be based entirely on your decisions: decisions of other participants will not affect your earnings.
Decisions and earnings of each participant will remain anonymous throughout the session.
Please turn off your cell phones and do not talk or in any way communicate with other participants.
If you have a question or problem at any point in this experiment, please raise your hand and one of the assistants will answer you.
The following rules are the same for all participants.

General rules

In this session you will participate in two different tasks.
Only one of the two tasks will be used to determine your final earnings.
More specifically, at the end of the experiment we will randomly select the task to pay to all participants by flipping a coin.
Now we give you the instructions for Task 1. You will receive the instructions for Task 2 at the end of Task 1.

Instruction for Task 1

The following figure reports the computer screen for Task 1.
It shows 19 pairs of lotteries, numbered from line L1 to line L19. Each pair is composed by lottery A and lottery B, respectively.
All lotteries have the same structure. Each lottery consists of 20 numbered tickets and two prizes, and involves randomly drawing a single ticket. The 20 tickets are in an envelop (Envelop 1) that you can check before the random draw.
For each line L1–L19, lottery A always gives the same two prices, namely 12.00 euros and 10.00 euros, and lottery B always gives the same two prizes, namely 22.00 euros and 0.50 euros.
For each lottery, the computer screen shows how many tickets have been assigned to each prize. Within each pair, the number of tickets assigned to the highest prize of the lottery is the same for lottery A and lottery B, and corresponds to the line number, e.g., 1 ticket in L1 and 19 tickets in L19.

	LOTTERY A	LOTTERY B
L1 ○	If the drawn ticket is no. **1**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **2** and **20**, you win ***10.00*** euros.	If the drawn ticket is no. **1**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **2** and **20**, you win ***0.50*** euros.
L2 ○	If the drawn ticket is between **1** and **2**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **3** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **2**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **3** and **20**, you win ***0.50*** euros.
L3 ○	If the drawn ticket is between **1** and **3**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **4** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **3**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **4** and **20**, you win ***0.50*** euros.
L4 ○	If the drawn ticket is between **1** and **4**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **5** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **4**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **5** and **20**, you win ***0.50*** euros.
L5 ○	If the drawn ticket is between **1** and **5**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **6** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **5**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **6** and **20**, you win ***0.50*** euros.
L6 ○	If the drawn ticket is between **1** and **6**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **7** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **6**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **7** and **20**, you win ***0.50*** euros.
L7 ○	If the drawn ticket is between **1** and **7**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **8** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **7**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **8** and **20**, you win ***0.50*** euros.
L8 ○	If the drawn ticket is between **1** and **8**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **9** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **8**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **9** and **20**, you win ***0.50*** euros.
L9 ○	If the drawn ticket is between **1** and **9**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **10** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **9**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **10** and **20**, you win ***0.50*** euros.
L10 ○	If the drawn ticket is between **1** and **10**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **11** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **10**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **11** and **20**, you win ***0.50*** euros.
L11 ○	If the drawn ticket is between **1** and **11**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **12** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **11**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **12** and **20**, you win ***0.50*** euros.
L12 ○	If the drawn ticket is between **1** and **12**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **13** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **12**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **13** and **20**, you win ***0.50*** euros.
L13 ○	If the drawn ticket is between **1** and **13**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **14** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **13**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **14** and **20**, you win ***0.50*** euros.
L14 ○	If the drawn ticket is between **1** and **14**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **15** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **14**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **15** and **20**, you win ***0.50*** euros.
L15 ○	If the drawn ticket is between **1** and **15**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **16** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **15**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **16** and **20**, you win ***0.50*** euros.
L16 ○	If the drawn ticket is between **1** and **16**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **17** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **16**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **17** and **20**, you win ***0.50*** euros.
L17 ○	If the drawn ticket is between **1** and **17**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **18** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **17**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **18** and **20**, you win ***0.50*** euros.
L18 ○	If the drawn ticket is between **1** and **18**, you win ***12.00*** euros; otherwise, if the drawn ticket is between **19** and **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **18**, you win ***22.00*** euros; otherwise, if the drawn ticket is between **19** and **20**, you win ***0.50*** euros.
L19 ○	If the drawn ticket is between **1** and **19**, you win ***12.00*** euros; otherwise, if the drawn ticket is no. **20**, you win ***10.00*** euros.	If the drawn ticket is between **1** and **19**, you win ***22.00*** euros; otherwise, if the drawn ticket is no. **20**, you win ***0.50*** euros.

○

Please indicate the line starting from which you prefer playing lottery B rather than lottery A.
This means that: for all pairs of lotteries from L1 until the line before the indicated one, you would play lottery A; for all pairs of lotteries from the indicated line until L19, you would play lottery B.
In particular, if you indicate L1 it means that you would play lottery B for

every possible line; if you indicate L20 (last empty line), it means that you would play lottery A for every possible line.

At the end of the experimental session, if this task will be selected for payment, your earnings will be determined as follows:

- The computer will select randomly and with equal probability one of the 19 lines.
- Given the line selected by the computer, your choice will be used to determine the lottery in which you will participate.
- One of the assistants will draw randomly and with equal probability one of the 20 tickets from Envelop 1. The drawn ticket will determine the prize you will win in the lottery in which you have chosen to participate.

Instructions for Task 2

The following figure reports the computer screen for Task 2.
It shows 4 panels of 10 lotteries.
In each panel, each column indicates a lottery.
All lotteries have the same structure. Each lottery consists of 10 numbered tickets and two prizes, and involves randomly drawing a single ticket. The 10 tickets are in an envelop (Envelop 2) that you can check before the random draw.
The lowest prize is 0 euros for each lottery, while the highest prize is a positive amount of euros, this amount being different for each lottery.
For each lottery, the computer screen shows the probability of winning and the positive amount of euros you can win.
The probability of winning indicates the percentage of tickets assigned to the highest prize. For example:

- 100% means that all the 10 tickets are assigned to the highest prize; thus, whatever the ticket drawn, you win the correspondent positive amount of money;
- 50% means that if the ticket drawn is from 1 to 5 (5 included), you win the correspondent positive amount of money; if it is from 6 to 10, you win nothing.
- 10% means that if the ticket drawn is no. 1, you win the correspondent positive amount of money; if it is from 2 to 10, you win nothing.

PANEL 1

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.12**	**1.27**	**1.47**	**1.73**	**2.10**	**2.65**	**3.56**	**5.40**	**10.90**
I prefer	○	○	○	○	○	○	○	○	○	○

PANEL 2

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.20**	**1.50**	**1.90**	**2.30**	**3**	**4**	**5.70**	**9**	**19**
I prefer	○	○	○	○	○	○	○	○	○	○

PANEL 3

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**1.66**	**2.50**	**3.57**	**5**	**7**	**10**	**15**	**25**	**55**
I prefer	○	○	○	○	○	○	○	○	○	○

PANEL 4

Prob. of Winning	**100%**	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**	**20%**	**10%**
Euros	**1**	**2.20**	**3.80**	**5.70**	**8.30**	**12**	**17.50**	**26.70**	**45**	**100**
I prefer	○	○	○	○	○	○	○	○	○	○

For each of the 4 panels of lotteries below, please indicate the lottery you would like to play.

At the end of the experimental session, if this task will be selected for payment, your earnings will be determined as follows:

- The computer will select randomly and with equal probability one of the 4 panels of lotteries.
- Given the panel selected by the computer, your choice will be used to determine the lottery in which you will participate.
- One of the assistants will draw randomly and with equal probability one of the 10 tickets from Envelop 2. The drawn ticket will determine the prize you will win in the lottery in which you have chosen to participate.