All Over the Map: Heterogeneity of Risk Preferences across Individuals, Prospects, and Countries*

Olivier l'Haridon†

Ferdinand M. Vieider‡

January 26, 2016

Abstract

We analyze the risk preferences of 2939 subjects across 30 countries on all continents. Using structural modeling, we explore heterogeneity in risk preferences across three dimensions: i) between individuals; ii) between prospects; and iii) between countries. Preferences in non-Western countries differ systematically from those found in Western countries, hitherto considered universal. Reference-dependence and likelihood-dependence are both found to play a role in describing preferences. While we confirm previous results on individual characteristics explaining little of overall preference heterogeneity, between countries a few macroeconomic indicators can explain a considerable part of the heterogeneity. The heterogeneity explained furthermore differs across decision parameters, being low for pure risk aversion measures, but higher for measures of noise and for rationality parameters.

Keywords: risk preferences; heterogeneity;

JEL-classification: C93; D03; D80; O12

*Ferdinand Vieider gratefully acknowledges generous financial support from the Excellence Initiative at the University of Munich and the WZB Berlin Social Science Center. Olivier l'Haridon acknowledges financial support from the Institut Universitaire de France and Rennes Metropole District. We would like to thank the following people for helpful comments and suggestions: Christoph Rheinberger, seminar participants at the University of Oxford, Seoul National University, King's College London, the University of Lund, and the University of Trier. All errors remain ours alone. The following people provided help with translations and in organizing and running the experiments: Clara Inés Villegas-Palacio, Marta Serra Garcia, Xiangdong Qin, Shuwen Li, Eva Xie, Jing Yu, Haileselassie Medhin, Yoshi Saijo, Takao Kusakawa, Frauke Mattison Thompson, Maria Angélica Naranjo, Francisco Alpizar, Phanith Chou, Phumsith Mahasuweerachai, Nghi Truong, Jiang Chong, Sunday Adewara, Martine Visser, Ranoua Bouchouicha, Peter Martinsson, Thorsten Chmura, Mathieu Lefebvre, Jolanda Ygosse Battisti, Michal Krawczyk, Michal Bauer, Jorge Dresdner, Hrvoje Stojic, Lachlan Deer, Diego Aycinena, Jorge Chang, Ashraf Eid, Lubomír Cingl, Alexis Belianin, and Gautam Gupta.

†Université de Rennes, France

‡University of Reading, Department of Economics; and WZB Berlin Social Science Center, Risk and Development Group. Email: f.vieider@reading.ac.uk

1 Motivation

We present insights on risk preferences based on data obtained in controlled experiments with 2939 subjects across 30 countries. The richness of the observations obtained for each subject allows us to describe heterogeneity in risk preferences across three different dimensions: i) heterogeneity between individuals; ii) heterogeneity within individuals between prospects; and iii) heterogeneity between countries. We examine the correlates of each type of heterogeneity, and the extent to which it can be explained by observable characteristics of the decision maker, the decision problem, or the country. Estimating random coefficient models, we can furthermore account for unobserved heterogeneity across all the different dimensions.

Heterogeneity between individuals has received considerable attention in the recent literature. For instance, von Gaudecker, van Soest and Wengström (2011) showed that there exists considerable heterogeneity in risk preferences, with only a small part of that heterogeneity explained by observable characteristics (see also Choi, Fisman, Gale and Kariv, 2007). Bruhin, Fehr-Duda and Epper (2010) explored heterogeneity by fitting a final mixture model to data from Switzerland and China. In terms of correlates, Sutter, Kocher, Glätzle-Rützler and Trautmann (2013) found that variations in risk preferences have low predictive power for the behavior of adolescents. Voors, Nillesen, Verwimp, Bulte, Lensink and Van Soest (2012) showed that individuals exposed to violence show lower levels of risk aversion, Dohmen, Falk, Huffman, Sunde, Schupp and Wagner (2011) showed a correlation with physical height as well as personal income and stock ownership, and Barsky, Kimball, Juster and Shapiro (1997) found correlations with stock ownership, as well as finding Asians in the US to be more risk tolerant than Caucasians. Choi, Kariv, Müller and Silverman (2014) detailed demographic and socio-economic correlates of rationality violations in risky decisions in a representative sample of the Dutch population.

Risk preferences have also been found to differ within individuals according to the decision problem's characteristics and parameters. These have traditionally been modeled as deviations from expected utility theory (*EU*; von Neumann and Morgenstern, 1944). One can classify such deviations into two main categories—*reference-dependence* and *likelihood-dependence* (with a potential third category due to error; see Conte, Hey and Moffatt, 2011). Reference-dependence leads to preferences being different for gains and losses relative to a reference point. It also results in loss aversion, the empirical finding that a given loss is attributed considerably more weight than an equivalent gain (Markowitz, 1952). While departing from classical interpretations of EU postulating preferences over lifetime wealth, reference-dependence has been increasingly integrated into expected utility models of late (Diecidue and van de Ven, 2008; Kőszegi and Rabin, 2007; Sugden, 2003; von Gaudecker et al., 2011). Likelihood-dependence constitutes a departure from EU whereby probabilities are not weighted linearly, but are subjectively distorted (Abdellaoui, Baillon, Placido and Wakker, 2011; Barseghyan, Molinari, O'Donoghue and Teitelbaum, 2013; Preston and Baratta, 1948). Both reference-dependence and likelihood-dependence are integrated into cumulative prospect theory (*CPT*; Tversky and Kahneman, 1992), the main descriptive theory of choice under risk today (Barberis, 2013; Starmer, 2000; Wakker, 2010).

Almost all the evidence on fitting decision models currently derives from Western, industrialized, countries.[1] In the absence of systematic comparisons, such evidence is often implicitly assumed to represent universal decision patterns. In a provocative article, however, Henrich, Heine and Norenzayan (2010) showed that many 'established' findings in the social sciences did not fare well once exposed to a rigorous test across different cultures. They concluded that most people are quite different from the usual WEIRD —Western, Educated, Industrialized, Rich, and Developed—subject pools used in typical lab experiments. So far, most estimations of descriptive models of choice under risk have yielded quite similar

[1]A recent departure from this rule are the data presented by Bruhin et al., 2010, who estimate the preferences of Chinese as well as Swiss students. A further exception is constituted by Tanaka, Camerer and Nguyen (2010), who estimated risk preferences of farmers in Vietnam. Other paper presenting comparative evidence from several countries typically use hypothetical measures and/or relatively simple measures at the individual levels (Falk, Becker, Dohmen, Enke, Huffman and Sunde, 2015; Rieger, Wang and Hens, 2014).

results. That may well be because they were mostly obtained in the West. For instance, of the 22 empirical estimations of prospect theory functionals listed in the overview by Booij, Praag and van de Kuilen (2010), not a single one was obtained in a low or middle income country.

We contribute to the literature in several ways. First of all, we show that decision patterns in non-Western countries differ substantially from those considered hitherto universal based on observations from WEIRD countries. These differences are systematic, with less developed countries exhibiting significantly lower levels of risk aversion. This casts doubt on 'strong' interpretations of prospect theory, which incorporate typical parameter values in addition to the mathematical framework of the theory. Other regularities inferred from Western data, such as risk aversion increasing in the probability of winning a prize (Abdellaoui, 2000; Tversky and Wakker, 1995; Wu and Gonzalez, 1996), appear to be universal. Relative to von Gaudecker et al. (2011), we show that allowing for richer decision patterns across prospects by adopting more flexible models does not solve the issue that little heterogeneity is explained by observable characteristics at the individual level. This conclusion holds especially for our risk aversion parameters, while the heterogeneity in rationality parameters we observe can be explained by observables to a larger extent.

In terms of observable heterogeneity, we confirm standard effects of physical characteristics like sex and height across different cultures, as well as adding new insights on study major and grade point average, which serve to inform the debate on whether cognitive ability impacts economic preferences (Andersson, Tyran, Wengström and Holm, 2015; Benjamin, Brown and Shapiro, 2013; Dohmen, Falk, Huffman and Sunde, 2010). We confirm the conclusion that much of the observed heterogeneity remains unexplained by individual characteristics across all countries. At the same time, however, a small set of macroeconomic characteristics can capture a considerable part of the between-country heterogeneity, so that our conclusions at the macro level are qualitatively different from those at the individual level.

This paper proceeds as follows. Section 2 introduces the theoretical setup and empirical strategy. Section 3 describes the subject pool and the experimental procedures. Section 4 presents results on the main correlates of risk preferences at the individual and macroeconomic level. Section 5 introduces heterogeneity across unobservable characteristics, and compares total to explained heterogeneity at both the individual and the macroeconomic level. Section 6 discusses the results and concludes the paper.

2 Theory and empirical strategy

2.1 Theoretical setup

We model preferences using cumulative prospect theory (Tversky and Kahneman, 1992). Let $\xi = (x, p; y)$ be a binary prospect, where p represents the probability of winning or losing x, and y obtains with a complementary probability $1 - p$, $|x| > |y|$. We describe choices between such binary prospects and sure amounts of money. Under CPT, utility is generated over changes in wealth rather than over total wealth as under original expected utility theory. Preferences are thus reference-dependent, in the sense that they may differ for gains and losses relative to a reference point. The experiment was framed in such a way that the reference point corresponds to zero—the standard assumption in the literature (Abdellaoui et al., 2011; Bruhin et al., 2010). For outcomes that fall purely into one domain, i.e. $x > y \geq 0$ or $0 \geq y > x$, we can represent the utility of a prospect ξ, $U(\xi)$, as follows:

$$U(\xi) = w^j(p)v(x) + [1 - w^j(p)]v(y) \tag{1}$$

whereby the probability weighting function, $w(p)$, is a continuous and strictly increasing function that maps probabilities into decision weights, and which satisfies $w(0) = 0$ and $w(1) = 1$; the superscript j indicates the decision domain and can take the values $+$ for gains and $-$ for losses; and $v(.)$ represents a utility or value function which indicates preferences over outcomes, with a fixed point such that $v(0) = 0$. Under CPT, utility curvature cannot be automatically equated with risk preferences, since the latter are determined jointly by the utility and the weighting functions (Schmidt and Zank, 2008). For mixed prospects, where $x > 0 > \ell$, the utility of the prospect can be represented as:

$$U(\xi) = w^{+}(p)v(x) + w^{-}(1-p)v(\ell) \tag{2}$$

In order to specify the model set out above, we need to determine the functional forms to be used. While prospect theory is very flexible, it has the disadvantage that the utility and weighting functions exhibit a substantial degree of collinearity when using parametric elicitation methods (Zeisberger, Vrecko and Langer, 2012). This becomes particularly bothersome in regression analysis, when it is hard to draw conclusions about risk preferences in case the different parameters contributing to risk aversion react to a regressant in opposite directions. To avoid this conundrum, we take advantage of the fact that empirically most of the interesting action is usually found to take place over the probability dimension in the range of typical experimental stakes (Fehr-Duda and Epper, 2012; Prelec, 1998). Assuming utility to be linear, we thus estimate a *dual* theory of reference-dependent expected utility, where risk preferences are fully expressed in the probability weighting functions and the loss aversion parameter (a similar model was axiomatized for rank-dependent utility by Yaari, 1987, and recently applied by Halevy, 2008; for an axiomatization of the reference-dependent dual we use here, see Schmidt and Zank, 2007).

Importantly, this simplification provides a good compromise between descriptive fit and tractability. In particular, it fits the data better than alternative simplifications, such as original expected utility ($z = 60.45, p < 0.001$; Vuong test[2]) or reference-depend expected utility models ($z = 44.68, p < 0.001$). A full prospect theory model with exponential utility is reported in the supplementary materials, and does not qualitatively affect any of our conclusions. Given our simplifying assumption, the value function is defined as:

[2]All results are stable to using a Clark test instead.

$$v(x) = \begin{cases} x & \text{if } x > 0 \\ -\lambda(-x) & \text{if } x \leq 0 \end{cases} \quad (3)$$

where $\lambda > 1$ indicates loss aversion, generally represented as a kink in the utility function at the origin (Abdellaoui, Bleichrodt and Paraschiv, 2007; Köbberling and Wakker, 2005). For weighting, we adopt the 2-parameter weighting function proposed by Prelec (1998)[3]:

$$w^j(p) = exp(-\beta^j(-ln(p))^{\alpha^j}) \quad (4)$$

where j again indicates the different decision domains. The parameter α governs the slope of the probability weighting function, with $\alpha = 1$ indicating linearity of the weighting function (the EU case), and $\alpha < 1$ representing the typical case of *probabilistic insentivity*. The latter is best characterized in terms of upper or lower subadditivity (Tversky and Wakker, 1995), whereby the same difference in terms of probabilities results in a smaller difference in probability weights away from the endpoints of $p = 0$ and $p = 1$ than close to them. This results in the characteristic inverse S-shaped weighting function (Abdellaoui, 2000; Bleichrodt and Pinto, 2000; Kilka and Weber, 2001; Wu and Gonzalez, 1996). Lower subadditivity is often referred to as the *possibility effect* and can be formalized for a constant $\epsilon \geq 0$ as $w(q) - w(0) \geq w(q + p) - w(p)$ whenever $q + p \leq 1 - \epsilon$. Upper subadditivity is commonly known as the *certainty effect*, and can be formalized for a constant $\epsilon' \geq 0$ as $w(1) - w(1 - q) \geq w(p + q) - w(p)$ whenever $p \geq \epsilon'$.

This is illustrated in figure 1 for the special case in which $p = q$. Passing from a zero probability to a probability q can be seen to result in a decision weight $\pi(q) > q$, indicating the possibility effect (i.e., overweighting of small probabilities). Doubling this probability to $2q$, however, adds relatively little to the decision weight, as $\pi(2q) \ll 2\pi(q)$. A similar yet opposite pattern is observed for very large probabilities, with a large decision weight being attributed to the

[3]Using an alternative two-parameter function by Goldstein and Einhorn (1987) does not qaulitatively affect our results. We used the function developed by Prelec as it provides a significantly better fit to our data ($z = 3.606, p < 0.001$, Vuong, 1989, test).

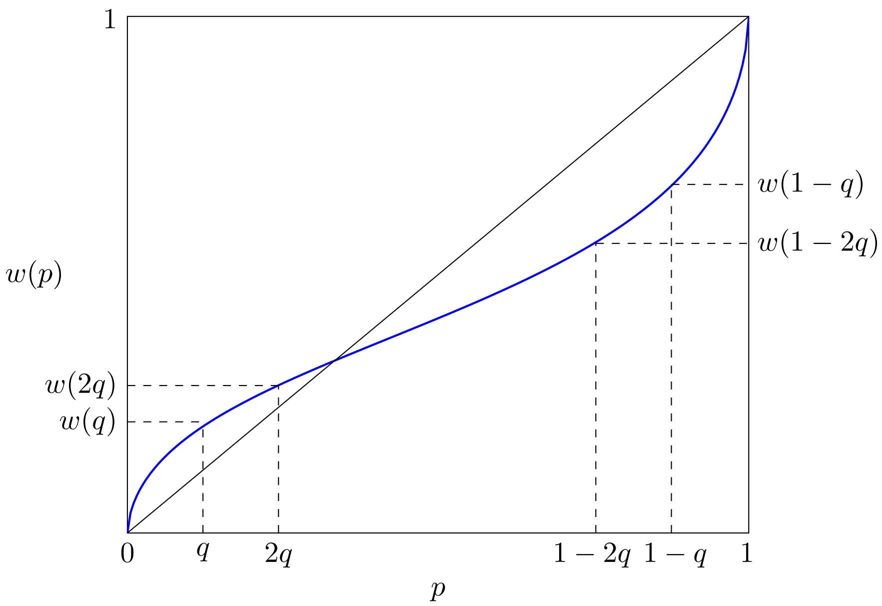


Figure 1: The certainty and possibility effects and probabilistic insensivity

difference between certainty and $p = 1 - q$, while subtracting further from that probability makes relatively little difference in terms of decision weights. This is known as the certainty effect.

The general characteristics of weighting functions just described are reflected in the parametric function adopted. The parameter α can be thought of as a rationality parameter, inasmuch as values different from 1 indicate deviations from linear utility weighting and hence from EU, generally considered to be normative (Tversky and Wakker, 1995). When $\alpha < 1$ probabilistic insensitivity merely predicts that the probability weighting function is first concave and then convex. However, this parameter cannot account for the level of absolute decision weights.[4] The parameter β precisely controls for this level. For gains, Gonzalez and Wu (1999) interpret the size of the decision weight as an index of the attractiveness of a prospect for the decision maker. With the Prelec parametric form, lower values of β will assign a greater weight to the higher outcome for gains and can be interpreted as a form of optimism. For losses, lower values of β assign a greater weight to the higher outcome in absolute value, which is akin to a form

[4]An inverse-S-shaped weighting function can be below the identity line, can cross the identity line at some point, or can be completely above the identity line.

of pessimism. When $\alpha = 1$ and utility is taken to be linear, risk attitudes over simple prospects $(x, p; 0)$ are solely explained by the β parameter in the same fashion that utility curvature explains risk aversion in expected utility (Prelec, 1998, p. 507). A higher value of β thus indicates increased risk aversion for gains, and increased risk seeking for losses.

2.2 Stochastic model and econometric specification

The model considered so far is fully deterministic, assuming that subjects know their preferences perfectly and execute them without making mistakes. Furthermore, it assumes that we can capture such preferences perfectly in our model. For a given prospect involving pure gains or losses, $\xi_i = (x_i, p_i; y_i)$, we can represent the modeled certainty equivalent, $\hat{ce}_i$, under this assumption as follows:

$$\hat{ce}_i = v^{-1}\left[w^j(p_i)v(x_i) + (1 - w^j(p_i))v(y_i)\right] \tag{5}$$

For mixed prospects $\xi_i = (x_i, p_i; \ell_i)$ with $x_i > 0 > \ell_i$, we can define the modeled equivalent loss $\hat{\ell}_i$ that makes the decision maker indifferent between the mixed prospect and the status quo:

$$\hat{\ell}_i = v^{-1}\left[\frac{w^+(p_i)v(x_i)}{\lambda w^-(1-p_i)}\right]^{5} \tag{6}$$

Both the modeled certainty equivalents $\hat{ce}_i$ in Equation 5 and the modeled loss equivalents $\hat{\ell}_i$ in Equation 6 depend on the preference parameters $\{\alpha^j, \beta^j, \lambda\}$.

We now introduce an explicit stochastic structure. We start from the observation that responses recorded in the experiment will be affected by noise, be it generated by errors in utility calculation, errors in recording the answers, or noise deriving from the mis-specification of the model relative to the true underlying decision process generating the data (Train, 2009). The observed certainty

[5]The loss aversion parameter λ in this expression is taken out of the utility function for losses, v^{-1}, so as to put it in evidence, given its central position in this expression.

equivalent ce_i will thus be equal to the certainty equivalent calculated from our model plus some independently distributed error term, or $ce_i = \hat{ce}_i + \epsilon_i$. We assume this error to be normally distributed, $\epsilon_i \sim \mathcal{N}(0, \sigma_i^2)$. The parameter σ_i indicates a so-called Fechner error (Hey and Orme, 1994).

We allow for three different types of heteroscedasticity following Bruhin, Fehr-Duda and Epper (2010). Firstly, the error is allowed to differ between gains and losses. We assume that the error parameter for losses is equal to the error parameter for gains plus a domain-specific error component ω. For mixed prospects, we adopt the error for losses, since it is the loss amount that varies in the mixed choice lists. Secondly, we allow the error term to depend on the specific prospect, or rather, on the difference between the high and low outcome in the prospect, such that $\sigma_{ji} = \sigma_j |x_i - y_i|$.[6] For the mixed prospects, the error term depends on the maximum range in the loss domain. This takes into account that the error may be related to the length of the choice list, which will vary with the difference between the two outcomes of the prospect given fixed steps between the sure amounts. Finally, we let the error term σ depend on the characteristics of the decision maker, n.

We can express the probability density function $\psi(.)$ for a given subject n and prospect ξ_i as follows

$$\psi(\theta_n, \xi_i) = \frac{1}{\sigma_{nij}} \, \phi \left(\frac{\hat{ce}_{ni}(\alpha^j, \beta^j, \lambda) - ce_{ni}}{\sigma_{nij}} \right) \tag{7}$$

where ϕ is the standard normal density function, and $\theta_n = \{\alpha_n^j, \beta_n^j, \lambda_n, \sigma_n, \omega\}$ indicates the vector of individual parameters. The $j = +$ index is omitted from the parameter σ_n for notational convenience. For mixed prospects, $\hat{ce}_i$ and ce_i have to be replaced by $\hat{\ell}_i$ and ℓ_i respectively in Equation (7).

The individual likelihood function is equal to the product of the density functions above across all prospects:

[6] Wilcox (2011) pointed out a potential probelm when applying such a model in a discrete choice setup, whereby the probability of choosing the riskier prospect may be increasing in risk aversion in some cases. This probelm does not apply in our setting. Also, Apesteguia and Ballester (2014) have shown that this probelm does not occur even in discrete choice models when a derived certainty equivalent is compared to a sure amount, as in our setup.

$$L_n(\theta_n) = \prod_i \psi(\theta_n, \xi_i) \tag{8}$$

We let the vector of parameters depend linearly on the observable characteristics of decision makers, such that $\theta_n = \theta_k + X_n\gamma$, where θ_k is a vector of constants and X_n represents a matrix of observable characteristics of the decision maker.[7] For simplicity, the parameter ω is assumed to be independent of the characteristics of the decision maker. Taking logs and summing over individuals, we obtain the following log-likelihood function:

$$LL(\theta_k, \gamma) = \sum_{n=1}^{N} \log\left[L_n(\theta_n)\right] \tag{9}$$

Furthermore, we use a random coefficient model to take into account unobserved heterogeneity in addition to the observed heterogeneity captured by γ in the model above. This amounts to estimating the distribution of the individual-specific parameters θ_n. We make two assumptions here. First, we transform the parameters using an exponential function, thus imposing that all individual parameters be positive. Second, we assume the parameter distributions based on unobservable characteristics to be normally distributed, independent of the observable characteristics, and independent of each other. This amounts to assuming that ζ, the vector of random effects, follows a multivariate normal distribution with mean zero and diagonal covariance matrix $\Omega = \Sigma\Sigma'$.[8] Conditional on a given realization of ζ, the contribution to the likelihood for subject n is given by Equation (8). The unconditional contribution to the likelihood for subject n is:

$$L_n(\theta_k, \gamma, \Sigma) = \int_{\mathbb{R}^6} \prod_i \psi(\theta_n, \xi_i) f(\zeta|\Omega) d\zeta \tag{10}$$

Where $f(.)$ denotes the multivariate normal distribution. Taking logs and sum-

[7] An alternative procedure is to estimate the model at the individual level, and to regress the parameters one by one on observable characteristics. Such individual data fitting is, however, liable to result in outliers, which then need to be dealt with in regression anlysis. Such an approach is furthermore less desirable inasmuch as information on the error term is largely lost in regressions, which only use point estimates of the parameters.

[8] As above, the parameter ω is assumed to be constant.

ming over individuals gives the log-likelihood function to be maximized.

We estimate the log-likelihood function (9) in Stata using standard estimation techniques. The errors are always clustered at the subject level. Because the multiple integral in Equation (10) does not have a closed-form solution, we estimate the log-likelihood function by maximum-simulated likelihood. The estimation is performed in Matlab using Halton sequences of length 500 per individual. Estimations employ the BFGS algorithm.

3 Experimental setup and methods

The experiment was conducted in 30 countries distributed across all inhabited continents. The countries were chosen according to the economic importance, geographical location, and to obtain diversity across dimensions such as GDP per capita and the Hofstede (1980) cultural attitudes scales.

A total of 2939 subjects took part in the experiment. Subjects were generally recruited at major public universities located in the capital or in other major cities of a country. Exceptions to this rule were Brazil, Malaysia, Saudi Arabia, and Tunisia, where we conducted the experiment at a private university (see Appendix for the exact location of the experiments). We made every effort to keep conditions as similar as possible across countries. We recruited subjects using flyers, which announced economic experiments in which subjects could earn money according to their choices. Amounts to be won where not mentioned. In countries where we could recruit through standing subject pools, we only recruited subjects who were relatively new to experiments (< 3) in order to keep conditions as equal as possible across countries. We tried to recruit subjects with an eye to equal sex proportions and to a wide representation of study majors. This did not always work to the desired point—in Saudi Arabia, for instance, our male contact was not allowed to interact with female students, so that we have an all male sample. An overview of some of the main subject characteristics can be found in the Appendix. The complete instructions are included in the supplementary materials (for languages other than English, see www.ferdinandvieider.com/instructions.html).

A total of 44 prospects were included in the study. Prospects were kept in a fixed order so as to make the task easier to understand. Since the experiment was conducted using paper and pencil, this made the organization more straightforward, and avoided potential issues deriving from different order proportions in different countries. A large-scale pilot with 330 subjects in Vietnam showed that preferences elicited in such a fixed order were no different from those elicited in a randomized order, while resulting in lower noise levels (results available upon request). Gains were always presented first. There were 14 prospects for risky gains and 13 prospects for risky losses, plus one mixed prospect to determine loss aversion. For both gains and losses, we presented prospects with 50-50 probabilities first, respectively $\{5, 0; 10, 0; 20, 0; 30, 0; 30, 10; 30, 20\}$ and $\{-5, 0; -10, 0; -20, 0; -20, -5; -20, -10\}$. These prospects were followed by prospects in order of ascending probability, with $p = i/8, i = 1, ..., 8$, offering either the PPP-equivalent of Euro 20 or 0 (-20 or 0 for losses), as well as 20 or 5 (-20 or -5) with the two extreme probabilities. Losses were always implemented from an endowment equal to the maximum possible loss, given conditional on the loss part being selected for payoff determination.

In order to guarantee comparability across countries, we converted the payoffs using purchasing power parity (*PPP*). All experiments were run between September 2011 and October 2012. The duration of the experiment was about one hour, and the expected payoff for an expected value maximizer was about 18 Euros, including a show-up fee of 4 Euros. We used PPP data from the World Bank for 2011 as our main conversion tool. In addition, we checked the conversion rates using net hourly wages of student assistants at the university where the experiments were carried out. Adjustments based on the wage rates mainly aided us in rounding decisions. One may be worried that differences between countries may nonetheless be influenced by imprecisions in PPP conversions. Pilots showed that stake variations in the range of $\pm 20\%$ did not impact estimated risk preferences (Vieider, 2012). Another issue in international comparisons is that one must by necessity abandon the random allocation to treatments, since the 'treatment' of interest is given by the socio-cultural and socio-economic background of subjects. To ensure that differences were not simply driven by random selection into treatments, in another pilot Vieider, Chmura, Fisher, Kusakawa, Martinsson, Mattison Thompson and Sunday (2015b) examined the differences in preferences obtained at various locations within a country. Almost no within-country differences in risk preferences were found once observable characteristics of decision makers were controlled for. Potential selection effects deriving from using only students will be further discussed below, based on results obtained in some of the countries with rural population samples.

For each prospect, subjects faced a choice between sure amounts varying in equal steps between the minimum and maximum amount in the prospect, and the prospect itself. The sure amount always covered the whole range of the prospect, to avoid issues deriving from cutting off choice lists arbitrarily (Andersson et al., 2015). The switching point at which subjects changed from preferring the prospect to preferring the sure amount (and *vice versa* for losses) was encoded as the certainty equivalent of the prospect, taking the average of the last sure amount for which the prospect was chosen and the first sure amount chosen. Subjects were explicitly told not to switch back once they had first switched. This was meant to exclude the possibility of obtaining multiple switching rates that differed between countries, and to have to exclude such subjects, since it is impossible to impute a preference satisfying monotonicity to multiple switchers. Having a unique switching point has the further advantage of enabling the use of more efficient econometric techniques, in which the density around the switching point is used directly in determining preferences (see also Bruhin et al., 2010). At the end of the game, one of the lines for which a decision had to be made between a prospect and a sure amount was randomly selected for real pay. This provides incentives to reveal one's true valuation and is the standard procedure in the literature (Abdellaoui et al., 2011; Cubitt, Starmer and Sugden, 1998).

4 Results

We present the results in three stages. We start by presenting data on the between-country comparison. This involves showing differences between countries, as well as trying to determine possible factors explaining such differences. The second stage looks at individual-level correlates controlling for country fixed effects. Stage three then takes a look at overall heterogeneity and the extent to which the latter can be explained through individual and country characteristics.

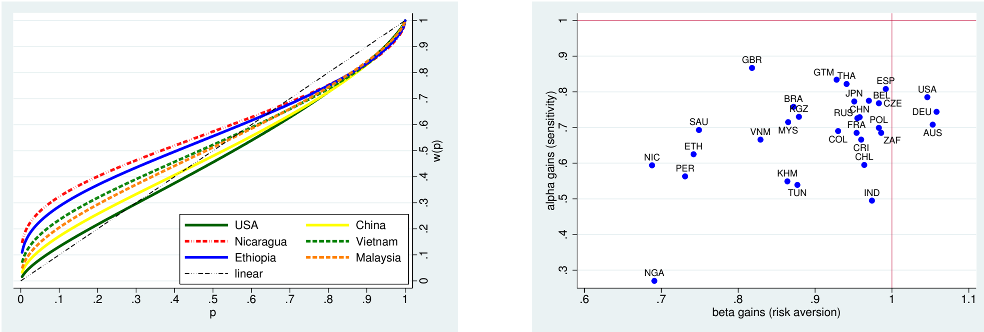
4.1 Between-country differences

We start by showing differences between countries. The effects shown are based on a regression with country fixed effects and a female dummy, added because the proportion of females differs across countries (gender effects in our data will be discussed below). Figure 2(a) shows some typical probability weighting functions for gains. The USA display the pattern hitherto thought of as typical—small probabilities are overweighed, moderate to large probabilities underweighted, and the function crosses the 45° line at around 0.3 (Abdellaoui, 2000; Bleichrodt, Pinto and Wakker, 2001; Wu and Gonzalez, 1996).[9] While China only displays slightly less risk aversion than the US (consistent with the results of Bruhin et al., 2010), other countries such as Vietnam, Ethiopia or Nicaragua have much lower degrees of risk aversion.[10] The pattern here is one of increased risk taking, which reaches up to well beyond the midpoint of the probability scale.

Figure 2(b) shows a scatter plot of the sensitivity and risk aversion parameters. All countries show probabilistic insensitivity, with a sensitivity parameter below 0.9. Most sensitivity parameters are also at or above 0.5, with the exception of Nigeria. In terms of the risk aversion parameter, Germany, Australia, and the US are the countries with the highest parameter values. They are then

[9] While some probability weighting functions have been found to cross at higher probabilities, this was found to happen in combination with more concave utility functions, and may derive from the collinearity between utility and elevation parameters of the weighting function. See e.g. the representative sample of the Swiss population described in Fehr-Duda and Epper (2012).

[10] If we allow for utility curvature in addition to probability weighting, this pattern is still captured mostly in the weighting function, and not in the utility function—see supplementary materials for details.



(a) Typical weighting functions

(b) Scatter plot of parameters

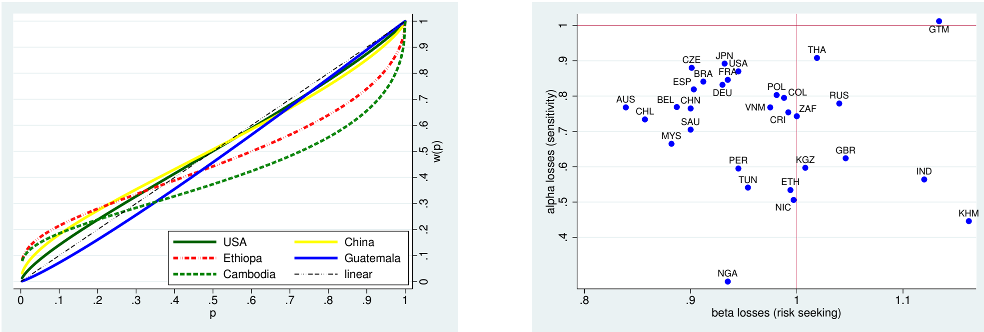
Figure 2: Probability weighting functions for gains

followed mostly by other industrialized countries such as Spain, Belgium, and Japan (although India is also far to the right). The next group to the left, roughly between a value of 0.8 and 0.9, is constituted mostly by middle income countries such as Brazil, Malaysia, Tunisia, and Vietnam (and with the UK as an exception to the middle income rule).[11] The most risk seeking group to the far left is constituted by low-income countries such as Ethiopia, Peru, Nicaragua, and Nigeria. We find a marginally significant correlation between the sensitivity and risk aversion parameters ($\rho = 0.356, p = 0.054$, Spearman rank correlation), going in the direction of more risk averse countries exhibiting higher probabilistic sensitivity.

Figure 3(a) shows typical weighting functions for losses. The patterns are less regular than for gains. In the US and China we again find a pattern of overweighting of small probabilities (now indicating risk *aversion*) and underweighting of large probabilities (indicating risk *seeking*), although the function appears to be somewhat flatter than for gains. Guatemala shows a pattern of mild risk seeking throughout. Ethiopia and Cambodia, on the other hand, have low sensitivity, which leads to substantial risk aversion for small probabilities and strong risk seeking for moderate to large probabilities. The findings are consistent with the

[11] In the UK we had mostly participants of foreign origin, which may account for this exceptional position for a rich, developed country; India, on the other hand, has a large propotion of women taking part in the experiment, with Indian women extremely more risk averse than Indian men, so that the gender effect is not fully captured by the average effect across all countries. These patterns will become clearer in the regression analysis below.

consensus in the literature that there is less consistency for losses than for gains (Abdellaoui, 2000). Especially the data for Ethiopia and Cambodia appear to depart somewhat from previously observed functions.



(a) Typical weighting functions

(b) Curvature parameters, scatter plot

Figure 3: Probability weighting functions for losses

Figure 5(d) conveys an idea of the general patterns across all 30 countries by showing the parameters of the weighting function for losses in a scatter plot. Once again, most countries have sensitivity parameters between 0.9 and about 0.5. The exceptions to this rule are Guatemala, which has an almost linear function, and Cambodia and Nigeria, which exhibit extremely low probabilistic sensitivity. The results for Australia again show high levels of risk aversion, now indicated by its position to the very left in the graph. As observed for gains, there appears to be again a general tendency for WEIRD countries to be relatively more risk averse, while poor and medium income countries are more risk seeking. This tendency is, however, much less clear than for gains. We find no significant correlation between the risk seeking and sensitivity parameters ($\rho = -0.178, p = 0.347$).

4.2 Economic Indicators

Having established the main differences between countries, it is now at the time to see whether we can find some systematic relations. Prime candidates for the explanation of the differences discussed above are measures of income. Table 1 regresses the parameters of the structural model on GDP (measured as the difference of per capita GDP from the US in logs) and the Gini coefficient (normalized so that it is 0 for the US) as an indicator of income inequality. The regression also controls for whether a participant is a self-declared national of the country or not (foreigner). We further control for sex, which will be discussed below (the results are also stable to inserting additional demographic controls). Finally, we use a dummy to indicate whether the experiment was executed at a private university (equal to 1 for Brazil, Malaysia, Saudi Arabia, and Tunisia), and a dummy to indicate countries that are members of the petroleum-producing cartel OPEC. Private-university students may be expected to come from relatively wealthier families, so that we would expect private university students to be relatively less risk averse due to the negative correlation between income and risk aversion generally found within countries (see Hopland, Matsen and Strøm, 2013, and Vieider, Chmura and Martinsson, 2012 for reviews of this correlation).[12] The OPEC dummy marks oil producing countries, in which GDP deriving from oil production does generally not accrue to the general population (this is standard in macroeconomic accounts of income levels, see e.g. Ashraf and Galor, 2011; Olsson and Hibbs, 2005).

We start by discussing the effects of GDP per capita. Probabilistic sensitivity decreases with poverty for both gains and losses, while noise increases. Poorer countries exhibit a more elevated weighting function for gains, indicating lower risk aversion, as well as a less elevated weighting function for losses, indicating increased risk seeking. In contrast to this effect for gains and losses, poor countries tend to exhibit higher levels of loss aversion than rich countries. Being a foreigner in a country shows no effect on risk preferences. Income distribution as measured by the Gini coefficient, on the other hand, shows a strong and highly significant effect on probabilistic sensitivity for losses, with more unequal countries exhibiting higher probabilistic sensitivity. Subjects from private universities show lower risk aversion for gains, and lower risk seeking for losses (marginally significant). OPEC countries have lower probabilistic sensitivity for both gains and losses. They are also significantly less risk averse for gains, while at the same

[12]This being a student subject pool, we have no measures of income at the individual level. We tried instead to obtain measures of stipends and expenses, however, the latter are extremely noisy and thus not very informative, so that we prefer not to report them here.

time exhibiting higher noise levels. In other words, they display the decision patterns typical of poorer countries as hypothesized, with effects aligned with those of relative poverty.

Table 1: Effects of income measures on risk preferences

N=2939, $LL = -217,069$	α^+	β^+	α^-	β^-	λ	σ
GDP difference	-0.058***	-0.063***	-0.095***	0.032***	0.194***	0.032***
	(0.007)	(0.006)	(0.008)	(0.007)	(0.024)	(0.002)
foreigner	0.026	-0.000	-0.006	0.027	-0.003	0.018**
	(0.034)	(0.031)	(0.040)	(0.029)	(0.081)	(0.007)
Gini coefficient	0.012	0.009	0.039***	0.008	-0.010	0.001
	(0.008)	(0.007)	(0.008)	(0.007)	(0.022)	(0.002)
private university	0.013	-0.064***	-0.047	-0.042*	0.091	-0.000
	(0.027)	(0.022)	(0.032)	(0.025)	(0.080)	(0.005)
OPEC	-0.264***	-0.145***	-0.270***	-0.055	0.432***	0.065***
	(0.031)	(0.025)	(0.031)	(0.034)	(0.149)	(0.006)
female dummy	✓	✓	✓	✓	✓	✓
constant	0.777***	1.010***	0.877***	0.914***	1.611***	0.157***
	(0.014)	(0.013)	(0.016)	(0.012)	(0.042)	(0.004)

* ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$)
GDP difference indicates the difference of GDP per capita from the US in logs
GDP data are from the World Bank tables for 2011
The Gini coefficient is the most recent before 2011 available; source: World Bank and CIA factbook

We may wonder whether the results here presented are stable. In particular the correlation with GDP may be suspected of proxying for other variables. We tested this by adding a number of variables to the above regression: i) geographical variables, such as absolute latitude and whether a country is landlocked, as well as continental dummies (Gallup, Sachs and Mellinger, 1999); ii) a variety of variables indicating institutional quality (Keefer and Knack, 1997); iii) dummies indicating legal origins (Porta, Lopez-de Silanes and Shleifer, 2008); and iv) data on the genetic diversity within each country (Ashraf and Galor, 2013). GDP per capita remains highly significant in all of the regressions. The other variables at best show weak or inconsistent effects on risk preferences—the full regressions can be found in the supplementary materials. The results are furthermore unlikely to stem from systematic selection effects of our student subjects as they have been found to generalize to non-student subject pools—see below for a more detailed discussion.

4.3 Individual Characteristics

Table 2 shows the effects of physical characteristics, in particular, sex, age, and height, while controlling for country effects using dummies. A large number of studies both in the economic laboratory and in the field have found gender differences in risk taking behavior (Eckel and Grossman, 2008). There remain some doubts whether gender effects are universal or whether they may vary between countries (Croson and Gneezy, 2009), and on the extent to which they may be task-specific (?). Gender effects in risk taking are important inasmuch as they may determine, e.g., the willingness to enter into competition (Balafoutas and Sutter, 2012; Niederle and Vesterlund, 2007) and the extent of stock market trading (Barber and Odean, 2001). We add to this discussion by showing evidence from a number of different countries, and by examining regularities over the probability and outcome spaces. We find women to display significantly lower probabilistic sensitivity than men for both gains and losses. At the same time, women exhibit significantly higher noise levels. For gains, we also find an effect on the elevation of the weighting function, going in the expected direction of women being more risk averse than men. For losses, the effect is found to go in the same direction of reduced risk seeking for women, but this effect fails to reach significance.

Table 2: Effects of physical characteristics on risk preferences

N=2939, $LL = -214,201$	α^+	β^+	α^-	β^-	λ	σ
female	-0.092***	0.036**	-0.072***	-0.021	-0.040	0.011***
	(0.018)	(0.016)	(0.020)	(0.016)	(0.052)	(0.004)
age	-0.008	0.002	0.009	0.016**	0.018	0.009***
	(0.009)	(0.008)	(0.009)	(0.008)	(0.022)	(0.002)
height	0.026**	-0.005	0.017	0.019**	-0.009	-0.005**
	(0.010)	(0.009)	(0.011)	(0.009)	(0.029)	(0.002)
country fixed effects	✓	✓	✓	✓	✓	✓
constant (USA)	0.767***	1.052***	0.863***	0.934***	1.616***	0.161***
	(0.032)	(0.028)	(0.038)	(0.027)	(0.088)	(0.007)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; age and height are z-scores
z-scores are used for age and height

Although we have a relatively narrow age range in our sample, we find older participants to be more noisy in their decision processes. We also find them to be more risk seeking for losses. We furthermore replicate recent findings of physical height having an impact on risk preferences (Dohmen et al., 2011). This effect goes in the direction of taller people being more sensitive towards changes in probabilities, although this effect is significant only for gains. For losses, taller people are found to be more risk seeking. Finally, taller people also have lower noise levels in their decision processes.[13]

Table 3 shows the effects of study major and grade point average (*GPA*; normalized to the same scale across countries and transformed into z-scores). GPA shows the effects we would expect to see using it as an—albeit imperfect—proxy for cognitive ability. We find it in first place to be related to the rationality measures in our data. A higher GPA is correlated with increased probabilistic sensitivity for both gains and losses, as well as reduced noise levels. A higher GPA also correlates with lower levels of loss aversion. This is consistent with studies that have found that loss aversion is reduced amongst professional traders (List, 2004), and with studies that have found debiasing mechanisms such as asking subjects to give reasons for their choices to result in lower loss aversion (Pahlke, Strasser and Vieider, 2012). We also find a marginally significant correlation of GPA with risk aversion for gains. This runs counter to accounts of risk aversion resulting from low cognitive ability (Benjamin et al., 2013), but is consistent with recent criticisms of that literature (Andersson et al., 2015).[14]

We also find some significant effects of study major (measured against economics students). We find hardly any differences for students of mathematics and engineering, the natural sciences, or medicine. The differences obtained for students of the social sciences, the humanities, arts, and other study majors (made up mostly by law students) appear, on the other hand, to be systematic. There is a general tendency amongst these majors to display lower probabilistic sensitivity. At the same time, they are more prone to errors or noise. We hypothesize that these effects are due to a lower exposure to formal mathematics,

[13]It is not entirely clear why such effects are found for taller people. One hypothesis is that physical height, or rather its lack, may reflect diseases and socio-economic conditions in childhood (Dercon and Porter, 2014; Maccini and Yang, 2009; Peck and Lundberg, 1995).

[14]The papers on cognitive ability and risk preferences discuss the relationship in a context of pervasive risk aversion. Since some of our countries are actually significantly risk seeking on average, the story may change if one reasons relative to a benchmark of risk neutrality. Since this is not the prime issue under investigation, we will not pursue this argument further.

Table 3: Effects of study major on risk preferences

N=2939, $LL = -213,8628$	α^+	β^+	α^-	β^-	λ	σ
GPA	0.028***	0.013*	0.042***	-0.006	-0.054**	-0.007***
	(0.008)	(0.008)	(0.009)	(0.008)	(0.024)	(0.002)
math & engineering	0.005	-0.008	0.031	0.027	-0.069	-0.004
	(0.022)	(0.020)	(0.025)	(0.020)	(0.068)	(0.005)
natural sciences	-0.041	0.007	-0.070**	-0.029	-0.101	0.007
	(0.030)	(0.026)	(0.034)	(0.025)	(0.086)	(0.006)
medicine	0.026	0.000	-0.016	-0.053	-0.113	-0.001
	(0.041)	(0.037)	(0.049)	(0.037)	(0.087)	(0.008)
social sciences	-0.095***	0.026	-0.097***	-0.019	-0.027	0.018***
	(0.028)	(0.024)	(0.030)	(0.024)	(0.071)	(0.005)
humanities	-0.077**	0.001	-0.022	0.011	0.018	0.018***
	(0.031)	(0.030)	(0.037)	(0.027)	(0.091)	(0.007)
arts	-0.041	-0.052	-0.123**	0.011	0.176	0.022**
	(0.051)	(0.040)	(0.050)	(0.050)	(0.156)	(0.009)
study other	-0.068***	0.016	-0.048*	-0.016	-0.045	0.017***
	(0.024)	(0.022)	(0.027)	(0.022)	(0.065)	(0.005)
physical characteristics	✓	✓	✓	✓	✓	✓
country dummies	✓	✓	✓	✓	✓	✓
constant	0.777***	1.038***	0.858***	0.947***	1.705***	0.159***
	(0.035)	(0.032)	(0.041)	(0.031)	(0.101)	(0.008)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

social sciences exclude economics students, who serve as reference

or a selection into these disciplines based on lower mathematical ability (which of these is really to blame we cannot determine with any degree of confidence).

Finally, we can address the effect of cultural variables on risk preferences. Some of the previous literature has emphasized accounts based on survey measures of cultural attitudes (Hofstede, 1980). For instance, Weber and Hsee (1998) compared four countries using hypothetical certainty equivalents for 50-50 prospects. They organized the results using the individualism-collectivism dimension, and concluding that relatively collectivistic societies such as China or Poland exhibit lower risk aversion compared to Germany and the US because of the implicit insurance provided by the closer social fabric. Notice, however, how their findings are also consistent with GDP differences. Rieger et al. (2014) explained risk preferences obtained in a survey with economics students in a large number of countries mostly based on uncertainty avoidance, another of the Hofstede cultural scales. Nonetheless, they also found effects of GDP which accord with our findings for gains. For losses, they found an effect going in the opposite direction, with poorer countries being less risk seeking.[15] Strangely, we find al-

[15]This difference in our findings is somewhat puzzling. It may be due to the real versus

most no explicative power of Hofstede's cultural scales—details are provided in the supplementary materials.

Another cultural dimension that has received some attention in the literature on risk preferences is religious affiliation (we do not have data on intensity of religious belief, which is yet another dimension). Results obtained so far are not consistent. Some researchers have concluded that Protestants are less risk averse than Catholics (Dohmen et al., 2011), while others have reached the opposite conclusion (Noussair, Trautmann, van de Kuilen and Vellekoop, 2013). There is virtually no evidence on religions other than the judeo-christian ones prevalent in the West. We find no difference between Catholics and Protestants in our data. While we find some differences for other religious affiliations, such as e.g. Jews being less risk averse than Protestants for gains (see also Barsky et al., 1997), these correlations are not systematic and likely spurious. The regressions and a discussion of the results are presented in the supplementary materials.

5 Explained and unexplained heterogeneity

5.1 Heterogeneity within individuals

We start by looking at heterogeneity in risk preferences within individuals depending on the prospect characteristics, i.e. at likelihood-dependence and reference-dependence. To this end, we estimate the random coefficients model with an empty set of covariates, i.e without any observable source of heterogeneity between individuals or countries added to the model. The coefficients for this model are shown in Table 4. The coefficients have been obtained following equation (10). The 'constant' and the diagonal elements of the variance-covariance matrix indicate the values of the variables transformed back to the original scale (from the log-normal estimated) by the delta method. The constants correspond to the medians of the parameter distribution. Standard errors for transformed parameters are also calculated using the delta method.

hypothetical nature of the measures, or to the use of willingness to pay by Rieger et al. (2014), which may shift the reference point. More evidence will however be needed to disentangle these accounts.

Table 4: Estimated Parameters for Model without Covariates

N=2939, $LL = -201,848$	α^+	β^+	α^-	β^-	λ	σ
Constant	0.66***	0.94***	0.73***	0.96***	2.00***	0.14***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.001)
diagonal elements of Ω	0.09***	0.11***	0.10***	0.10***	0.68***	0.005***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.06)	(0.001)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We find considerable heterogeneity in risk preferences across the population, as shown by the observation that all the diagonal elements of the covariance matrix are large and significant. The general model confirms evidence for reference-dependence and likelihood-dependence, for the two distributions of the sensitivity parameter for gains and losses are significantly different, with both medians below one. Any value of the sensitivity parameters significantly smaller or greater than 1 indicates a deviation from linear probability weights and thus from EU, with the more common case of values smaller than 1 indicating likelihood insensitivity. Insensitivity appears to be the norm. For gains, the distribution implies that 82% of the population have a sensitivity parameter below 1, with only 12% of the individuals characterized by a sensitivity value close to linear probability weighting (i.e with α^+ lying in the range $[0.9; 1.1]$). For losses, 76% of the population have a sensitivity parameter below 1 and 14% of the individuals have a sensitivity value close to 1. We also find considerable heterogeneity in loss aversion. The parameter estimates correspond to a distribution with mean 2.17, very close to the median estimate of 2.25 found by Tversky and Kahneman (1992), and a standard deviation 0.94. This distribution implies that 94% of the loss aversion parameters fall in the range $[1; 5]$, and corresponds to the usual benchmarks used in the literature (Barberis, 2013).

5.2 Heterogeneity between individuals

We next take a look at heterogeneity between individuals. To this end, we compare the model with no heterogeneity between individuals or countries to the one with country dummies added, and to one with both country dummies and individual characteristics added. The supplementary materials report correlations between the point estimates using the approach from the first part of the results and median values obtained from the random parameter estimates, and show that they are highly correlated, thus proving the consistency of the two approaches.

The comparison of the baseline model with an empty set of covariates to the more complex ones allows us to measure if the observed covariates can account for heterogeneity in estimated parameters. Following von Gaudecker et al. (2011), we compare the distributions of preference parameters implied by the observed covariates only to the overall distributions. We also examine the extent to which the heterogeneity explained by adding the individual characteristics will be different than the heterogeneity explained using the country dummies alone.

Figure 4 shows the curves corresponding to these approaches. The outermost curves represent the overall heterogeneity in the two estimations (with and without individual characteristics added), including heterogeneity across both observed and unobserved characteristics. Adding country dummies by definition explains all of the heterogeneity across countries. Such country dummies appear to explain a somewhat larger part of the overall heterogeneity for noise, followed by loss aversion and the sensitivity parameters. They capture much less of the overall heterogeneity of the risk preference parameters β^{+} and β^{-}.

To analyze this more formally, table 5 shows the variance decomposition of the various preference parameters. The first row of the table indicates that country dummies explain only a moderate proportion of the overall heterogeneity, especially for the two risk preference parameters, with 12.5% of the variance in risk aversion for gains explained by the country dummies, and only 7.4% of the variance in risk seeking for losses. This improves to over 30% of the variance for the sensitivity parameters. When it come to loss aversion and the noise term, somewhat more of their overall heterogeneity can be explained by the country dummies alone. In general, we conclude that there is more heterogeneity across individuals than across countries. Further adding individual characteristics to the regression, however, does not increase the explained variance by much, as is apparent from figure 4. Notwithstanding our more flexible model, which can account for a richer array of within-subject heterogeneity through reference-dependence and likelihood-dependence, our conclusions thus remain remarkably similar to the ones reached by von Gaudecker et al. (2011). Observable characteristics at the individual level contribute little to explaining overall heterogeneity in risk preferences.

5.3 Heterogeneity between countries

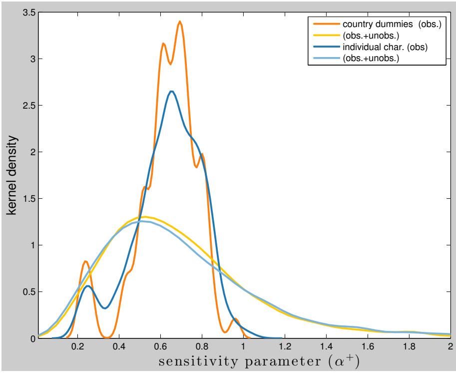
The purpose of this section is to determine to what extent we can explain between-country heterogeneity recurring to a few macroeconomic indicators rather than to a large set of country-specific dummies. Specifically, we will use the macroeconomic indicators used above, that is, GDP per capita, the Gini coefficient, and the private university and OPEC dummies. We also control for female since the proportion of females in the experiment differs between countries. Figure 5 shows the distribution of individual parameters based on country-specific dummies and macroeconomic indicators. The outermost curves represent the overall heterogeneity in the two estimations. The peaked curves correspond to distributions of preference parameters implied by the observed covariates only. Comparison between the two peaked curves shows what is lost when moving from country dummies to macroeconomics indicators in terms of observable characteristics.

The extent to which the variance explained by a random effect model based on macro indicators approaches the one explained by the country fixed effects alone is measured by comparing explained versus unexplained between-country heterogeneity. Table 5 shows the decomposition of the overall variance implied by country-specific dummies and by macroeconomic indicators.

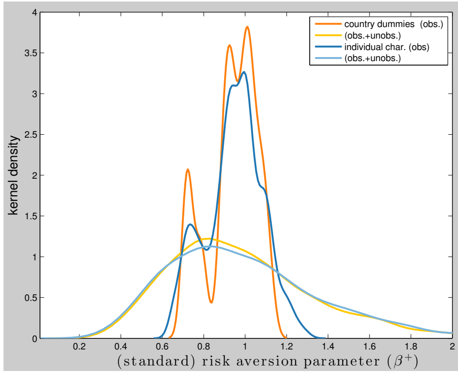
Table 5: Variance decomposition of preference parameters and heterogeneity between countries

N=2939	α^+	β^+	α^-	β^-	λ	σ
country dummies	0.332	0.125	0.306	0.074	0.326	0.415
macro indicators	0.223	0.071	0.193	0.028	0.184	0.280

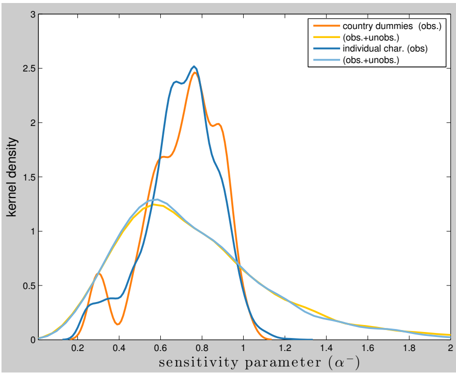
While obviously explaining less heterogeneity than the benchmark case established by the country dummies, the macroeconomic variables capture a substantial part, 38% to 67% of the between-country heterogeneity as captured by



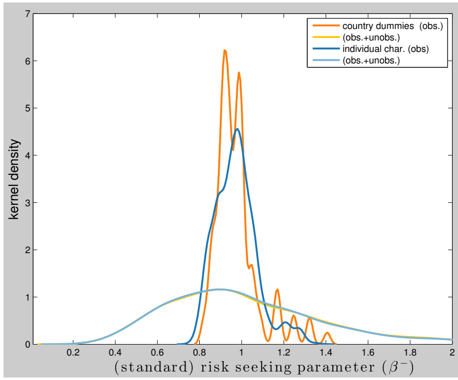
(a) Sensitivity gains



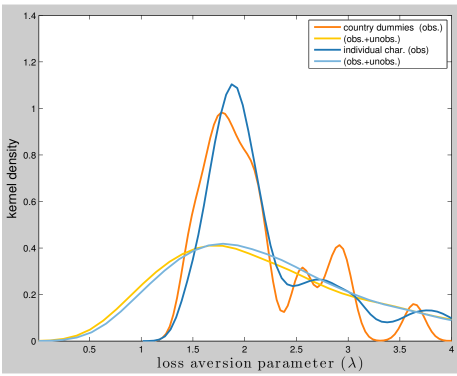
(b) Risk aversion gains



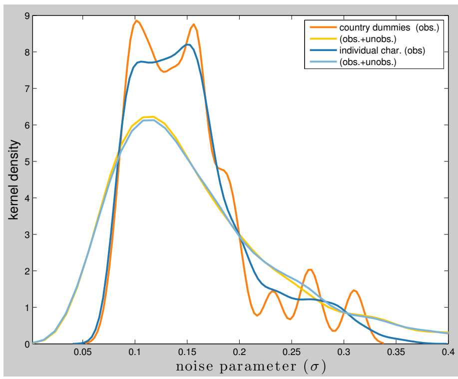
(c) Sensitivity losses



(d) Risk seeking losses



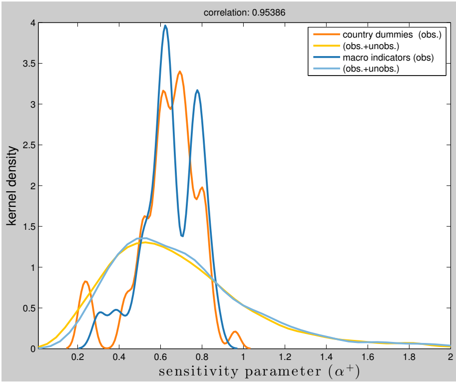
(e) Loss aversion



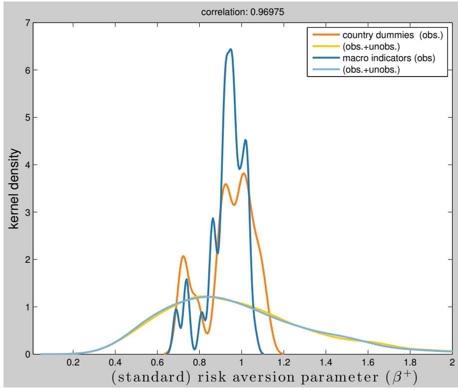
(f) Noise

Figure 4: Observable versus unobservable heterogeneity, individual characteristics
Light grey lines are estimated parameter distributions taking observed and unobserved heterogeneity into account. Dark grey lines represent the observed heterogeneity only and neglect the unobserved part. Densities are kernel density estimates over individuals.

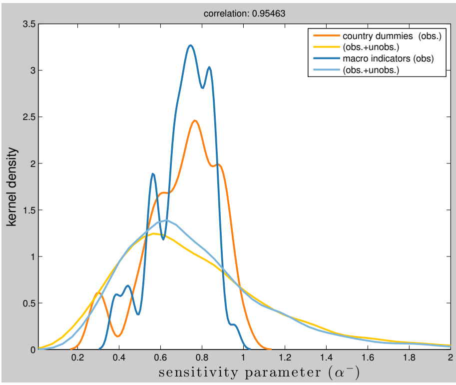
the country dummies for all parameters. Once again, they perform somewhat less well for the risk preference parameters, although still capturing more than half of the variance captured by country dummies for those parameters, with



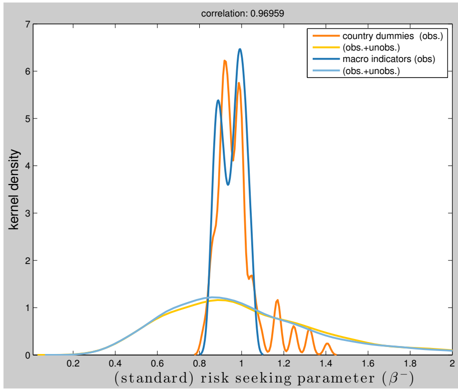
(a) Sensitivity gains



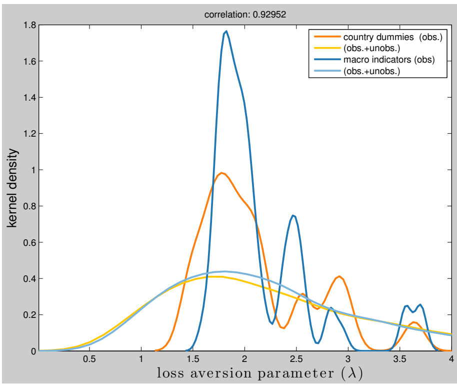
(b) Risk aversion gains



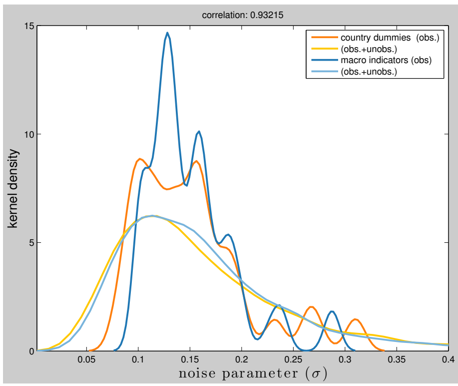
(c) Sensitivity losses



(d) Risk tolerance losses



(e) Loss aversion



(f) Noise

Figure 5: Observable versus unobservable heterogeneity, country-specific dummies and macroeconomic indicators

Light grey lines are estimated parameter distributions taking observed and unobserved heterogeneity into account. Dark grey lines represent the observed heterogeneity only and neglect the unobserved part. Densities are kernel density estimates over individuals.

the exception of standard risk seeking for losses. This stands in contrast to the effect found for the individual characteristics. We thus conclude that while the characteristics we observe at the individual level explain only a very small part of the overall heterogeneity between individuals, macroeconomic characteristics pick up on most of the between country differences.

6 Discussion and conclusion

We used data from 30 countries and 2939 subjects to examine heterogeneity in risk preferences across three dimensions—between individuals, within individuals across prospect characteristics, and between countries. Notwithstanding the flexible descriptive model of choice under risk, individual characteristics were found to explain relatively little of the total heterogeneity in risk preferences. Macroeconomic characteristics of countries, on the other hand, could capture a large proportion of the overall between-country heterogeneity. In terms of observable characteristics, we could replicate typical findings in the literature, such as gender effects and effects of physical height. At the same time, we found effects of GPA and study major on rationality parameters. The latter results seem in agreement with conclusions presented by Andersson et al. (2015), according to which cognitive ability influences mostly error terms, but shows no correlation with preferences if choice lists are balanced.

The weighting functions we have examined deviate considerably from what has been considered to be the universal pattern so far, at least in the aggregate. These deviations are best discussed in terms of the attributes of the weighting function as described by Prelec (1998), according to which weighting functions are: i) regressive, meaning that they intersect the diagonal from above; ii) asymmetric, crossing the diagonal at around 1/3; iii) inverse S-shaped, initially concave and later convex; and iv) reflective, so that $w^+(p) = w^-(p)$ for all p. Starting from gains all countries were indeed found to have a regressive function. The same holds for the inverse S-shape, which was also found for all countries. Asymmetry fairs much worse—few countries outside the Western or at least high income world conform to this property. Reflectivity was not explicitly addressed in this paper due to space constraints. Nevertheless, a casual comparison shows that it is violated in many countries even at the aggregate level (individual level violations have been know for a long time, see e.g. Cohen, Jaffray and Said, 1987, or Schoemaker, 1990).

Our findings thus show considerable deviations from the patterns observed in WEIRD countries. The lower risk aversion found in poor countries is furthermore surprising, as scholars have generally assumed poor countries to be *more* risk averse based on within-country results showing risk aversion to decrease in income or wealth (see e.g. Haushofer and Fehr, 2014, for a recent literature review reaching that conclusion). Clearly, one ought to be careful to draw inferences on general populations from a subject pool consisting purely of students. In particular, we may be worried that students in poorer countries could come from relatively wealthier and more educated families, thus potentially explaining the lower risk aversion found in those countries.

Such a systematic selection effect does, however, not constitute a plausible explanation for our results. Vieider, Truong, Martinsson and Pham Khanh (2013) carried out this same experiment with 207 farmers in Vietnam, and found them to be risk neutral on average, with the weighting function crossing the diagonal at about $p = 0.5$ under the same linear utility assumption as adopted here. Using a slightly different but comparable set of tasks, Vieider, Beyene, Bluffstone, Dissanayake, Gebreegziabher, Martinsson and Mekonnen (2014) showed that a large, representative sample of the rural Ethiopian highlands was risk seeking on average. These results are highly consistent with our student data, and exclude the selection hypothesis as a plausible explanation. Both studies also find a positive within-country correlation between risk tolerance and income, which gives rise to a paradox. Vieider et al. (2012) try and explain this paradox by relating it to long-term growth patterns, and establish the direction of causality as running from GDP per capita to risk preferences. Finally, Vieider, Lefebvre, Bouchouicha, Chmura, Hakimov, Krawczyk and Martinsson (2015a) show that the measures used in this data set also correlate significantly with measures obtained using unknown probabilities, as well as with qualitative measures of risk preferences asking subjects for their self-declared willingness to take risks, either in general or in specific contexts. This again indicates the consistency of the results.

Most measurements of risk preferences in developing countries have been executed using a single choice and often relying on very different elicitation designs (Binswanger, 1980), making the comparison to such results pointless. The most notable exception to this rule is a study by Tanaka et al. (2010), who measures the risk preferences of a sample of the rural Vietnamese population. They conclude that the risk preferences they measure are remarkably similar to those measured for American university students—a conclusion that clearly differs from ours. Their choice lists are, however, quite different from ours, and have not been used in Western countries, which again makes direct comparisons difficult.

Finally, we contributed novel findings in terms of the amount of overall heterogeneity explained by observable characteristics. Individual characteristics were found to explain little of the overall heterogeneity, confirming previous results. Nonetheless, allowing for the richer modeling structure induces us to reach some more muted conclusions. While we confirm the high degree of heterogeneity in risk aversion that remains unexplained, rationality parameters such as noise and probabilistic sensitivity, as well as loss aversion, can be explained to a larger degree. Furthermore, the conclusions reached on between-country heterogeneity depart considerably from those at the individual level. Adding only a few macroeconomic characteristics, most notably GDP, two dummies indicating whether the experiment was carried out at a private university and whether the country is a member of the oil producer cartel OPEC, and the Gini coefficient, could explain a large proportion of overall between country variance.

We can only speculate about the reasons behind the different results on explained versus unexplained heterogeneity at the individual versus the country level. One possibility is that average measures at the country levels will be less noisy, if some individuals contribute disproportionally to noise levels, e.g. because they have relatively unstable preferences. Another element consists in the observation that there are many more factors that we can control for in terms of between country heterogeneity in principle, even though we end up explaining a large part of this heterogeneity with just a few factors. Finally, between country heterogeneity is generally lower than individual heterogeneity, which may partially account for it being easier to explain.

Appendix A: Characteristics country by country

Table A.1: Number of subjects per country and principal characteristics

country	Sub.s	For.s	age	male	econ	math	natural	hum	arts	social	PPP/€	language	University	GDP	Gini
Australia	61	6	25.41	0.656	0.262	0.180	0.131	0.098	0.049	0.033	2 AUD	English	University of Adelaide	39,466	.305
Belgium	91	13	20.64	0.451	0.418	0.055	0.088	0.066	0.022	0.132	€1	French	University of Liege	38,633	.280
Brazil	84	1	20.86	0.683	0.964	0.000	0.000	0.012	0.000	0.000	2 Real	Portuguese	Escola de Administraão, São Paolo	11,719	.547
Cambodia	80	0	20.74	0.375	0.000	0.212	0.237	0.125	0.175	0.175	1500 Riel	Khmer	University of Phnom Penh	2,373	.444
Chile	96	0	21.46	0.479	0.000	0.000	0.229	0.000	0.000	0.260	500 Pesos	Spanish	Universidad de Conception	17,125	.521
China	204	0	21.55	0.608	0.127	0.451	0.181	0.083	0.005	0.064	4 RMB	Chinese	Jiao Tong, Shanghai	8,442	.480
Colombia	128	0	21.21	0.500	0.062	0.797	0.047	0.031	0.023	0.008	1500 Pesos	Spanish	Universidad de Medellin	10,103	.560
Costa Rica	106	5	22.71	0.666	0.292	0.179	0.113	0.009	0.019	0.132	500 Colones	Spanish	Universidad de Costa Rica, San Jose	12,236	.503
Czech Rep.	99	2	22.38	0.606	0.485	0.111	0.051	0.121	0.030	0.091	20 Kronas	Czech	Charles University, Prague	25,949	.310
Ethiopia	140	1	21.14	0.657	0.593	0.107	0.079	0.021	0.000	0.093	6 Birr	English	Addis Ababa University	1,116	.300
France	93	8	21.30	0.527	0.430	0.054	0.022	0.043	0.032	0.032	€1	French	University of Rennes 1	35,194	.327
Germany	130	32	26.52	0.515	0.115	0.400	0.108	0.115	0.008	0.023	€1	German	Technical University, Berlin	39,414	.270
Guatemala	84	1	22.20	0.464	0.345	0.179	0.000	0.119	0.036	0.131	6 Quetzales	Spanish	Universidad Francisco Marroquín	4,961	.559
India	89	0	21.01	0.303	0.697	0.000	0.022	0.112	0.090	0.034	22 Rupees	English	University of Kolkata	3,650	.368
Japan	84	0	21.74	0.512	0.095	0.417	0.107	0.107	0.000	0.048	120 Yen	Japanese	Hiroshima Shudo University	34,278	.376
Kyrgyzstan	97	2	20.02	0.485	0.639	0.000	0.000	0.072	0.000	0.289	25 KGS	Russian	University of Bishkek	2,424	.362
Malaysia	64	0	20.09	0.578	0.578	0.188	0.062	0.000	0.016	0.047	2 Ringgit	English	University of Nottingham Malaysia	15,589	.462
Nicaragua	120	1	20.94	0.550	0.917	0.025	0.000	0.000	0.000	0.000	10 Córdobas	Spanish	Universidad National Autonoma	2,940	.405
Nigeria	202	2	22.65	0.495	0.406	0.000	0.005	0.054	0.312	0.119	110 Naira	English	University of Lagos	2,532	.437
Peru	95	1	23.66	0.463	0.579	0.368	0.000	0.011	0.000	0.042	2 N. Soles	Spanish	Instituto del Peru	10,318	.460
Poland	89	1	24.00	0.517	0.427	0.079	0.067	0.169	0.000	0.124	2.4 Zloty	Polish	University of Warsaw	21,281	.341
Russia	70	8	20.56	0.500	0.729	0.129	0.000	0.086	0.000	0.014	22 Rubles	Russian	Higher School of Economics	21,358	.420
Saudi Arabia	65	12	21.74	1.000	0.585	0.308	0.000	0.000	0.000	0.000	4 Riyal	English	King Fahd University	24,434	.570
South Africa	71	18	22.44	0.606	0.451	0.254	0.056	0.056	0.014	0.042	8 Rand	English	University of Cape Town	11,035	.650
Spain	80	3	20.94	0.513	0.450	0.037	0.000	0.100	0.037	0.225	€1	Spanish	Universidad Pompeu Fabra	32,701	.320
Thailand	79	0	20.59	0.354	0.329	0.101	0.139	0.000	0.013	0.215	20 Baht	Thai	University of Khon Kaen	8,703	.536
Tunisia	74	0	22.26	0.527	0.230	0.473	0.081	0.000	0.000	0.000	2 Dinar	French	Universite Libre de Tunis	9,415	.400
UK	80	0	20.77	0.450	0.700	0.000	0.025	0.013	0.025	0.075	1 Pound	English	King's College London	36,511	.350
USA	97	22	21.32	0.495	0.144	0.206	0.113	0.041	0.031	0.186	$ 1	English	University of Michigan Ann Arbor	48,442	.450
Vietnam	87	0	20.20	0.575	0.667	0.057	0.034	0.000	0.011	0.023	8000 Dong	Vietnamese	Ho-Chi-Minh-City University	3,435	.357
Total	2939	139	21.83	0.530	0.402	0.189	0.069	0.056	0.040	0.089					

Sub.s stands for number of subjects, For.s for number of foreigners; econ etc. indicate study majors; PPP/€indicates exchange rates in purchasing power parity used for conversion
Gini coefficients are taken from the World Bank where available, else from the CIA World Factbook; 2011 or closest available
GDP refers to 2011 values in PPP, current US Dollars; source: World Bank

References

Abdellaoui, Mohammed (2000) 'Parameter-Free Elicitation of Utility and Probability Weighting Functions.' *Management Science* 46(11), 1497–1512

Abdellaoui, Mohammed, Aurélien Baillon, Lætitia Placido, and Peter P. Wakker (2011) 'The Rich Domain of Uncertainty : Source Functions and Their Experimental Implementation.' *American Economic Review* 101, 695–723

Abdellaoui, Mohammed, Han Bleichrodt, and Corina Paraschiv (2007) 'Loss Aversion Under Prospect Theory: A Parameter-Free Measurement.' *Management Science* 53(10), 1659–1674

Andersson, Ola, Jean-Robert Tyran, Erik Wengström, and Håkan J. Holm (2015) 'Risk Aversion Relates to Cognitive Ability: Preferences or Noise?' *Journal of the European Economic Association, forthcoming*

Apesteguia, José, and Miguel A. Ballester (2014) 'Discrete choice estimation of risk aversion.' *Working Paper*

Ashraf, Quamrul, and Oded Galor (2011) 'Dynamics and Stagnation in the Malthusian Epoch.' *The American Economic Review* 101(5), 2003–2041

_ (2013) 'The "Out of Africa" Hypothesis, Human Genetic Diversity, and Comparative Economic Development.' *The American Economic Review* 103(1), 1–46

Balafoutas, Loukas, and Matthias Sutter (2012) 'Affirmative Action Policies Promote Women and Do Not Harm Efficiency in the Laboratory.' *Science* 335(6068), 579–582

Barber, Brad M., and Terrance Odean (2001) 'Boys Will be Boys: Gender, Overconfidence, and Common Stock Investment.' *The Quarterly Journal of Economics* 116(1), 261–292

Barberis, Nicholas C. (2013) 'Thirty Years of Prospect Theory in Economics: A Review and Assessment.' *Journal of Economic Perspectives* 27(1), 173–96

Barseghyan, Levon, Francesca Molinari, Ted O'Donoghue, and Joshua Teitelbaum (2013) 'The Nature of Risk Preferences: Evidence from Insurance Choices.' *American Economic Review* 103(6), 2499–2529(31)

Barsky, Robert B., Miles S. Kimball, F. Thomas Juster, and Matthew D. Shapiro (1997) 'Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Survey.' *Quarterly Journal of Economics* 112(2), 537–579

Benjamin, Daniel J., Sebastian A. Brown, and Jesse M. Shapiro (2013) 'Who Is 'Behavioral'? Cognitive Ability and Anomalous Preferences.' *Journal of the European Economic Association* 11(6), 1231–1255

Binswanger, Hans P. (1980) 'Attitudes toward Risk: Experimental Measurement in Rural India.' *American Journal of Agricultural Economics* 62(3), 395–407

Bleichrodt, Han, and Jose Luis Pinto (2000) 'A Parameter-Free Elicitation of the Probability Weighting Function in Medical Decision Analysis.' *Management Science* 46(11), 1485–1496

Bleichrodt, Han, Jose Luis Pinto, and Peter P. Wakker (2001) 'Making Descriptive Use of Prospect Theory to Improve the Prescriptive Use of Expected Utility.' *Management Science* 47(11), 1498–1514

Booij, Adam S., Bernard M. S. van Praag, and Gijs van de Kuilen (2010) 'A parametric analysis of prospect theory's functionals for the general population.' *Theory and Decision* 68(1-2), 115–148

Bruhin, Adrian, Helga Fehr-Duda, and Thomas Epper (2010) 'Risk and Rationality: Uncovering Heterogeneity in Probability Distortion.' *Econometrica* 78(4), 1375–1412

Choi, Syngjoo, Raymond Fisman, Douglas Gale, and Shachar Kariv (2007) 'Consistency and Heterogeneity of Individual Behavior under Uncertainty.' *The American Economic Review* 97(5), 1921–1938

Choi, Syngjoo, Shachar Kariv, Wieland Müller, and Dan Silverman (2014) 'Who Is (More) Rational?' *American Economic Review*

Cohen, Michele, Jean-Yves Jaffray, and Tanios Said (1987) 'Experimental Comparison of Individual Behavior under Risk and Uncertainty for Gains and for Losses.' *Organizational Behavior and Human Decision Processes* 39, 1–22

Conte, Anna, John D. Hey, and Peter G. Moffatt (2011) 'Mixture models of choice under risk.' *Journal of Econometrics* 162(1), 79–88

Croson, Rachel, and Uri Gneezy (2009) 'Gender Differences in Preferences.' *Journal of Economic Literature* 47(2), 1–27

Cubitt, Robin P., Chris Starmer, and Robert Sugden (1998) 'On the Validity of Random Lottery Incentive Systems.' *Experimental Economics* 1, 115–131

Dercon, Stefan, and Catherine Porter (2014) 'Live aid revisited: Long-term impacts of the 1984 Ethiopian famine on children.' *Journal of the European Economic Association* 12(4), 927–948

Diecidue, Enrico, and Jeroen van de Ven (2008) 'Aspiration Level, Probability of Success and Failure, and Expected Utility.' *International Economic Review* 49(2), 683–700

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde (2010) 'Are Risk Aversion and Impatience Related to Cognitive Ability?' *American Economic Review* 100, 1238–1260

Dohmen, Thomas, Armin Falk, David Huffman, Uwe Sunde, Jürgen Schupp, and Gert G. Wagner (2011) 'Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences.' *Journal of the European Economic Association* 9(3), 522–550

Eckel, Catherine C., and Philip J. Grossman (2008) 'Men, Women, and Risk Aversion: Experimental Evidence.' In 'Handbook of Experimental Economics Results Vol. 1' pp. 1061–1073

Falk, Armin, Anke Becker, Thomas Dohmen, Benjamin Enke, David Huffman, and Uwe Sunde (2015) 'The nature and predictive power of preferences: Global evidence.' *Working paper*

Fehr-Duda, Helga, and Thomas Epper (2012) 'Probability and Risk: Foundations and Economic Implications of Probability-Dependent Risk Preferences.' *Annual Review of Economics* 4(1), 567–593

Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger (1999) 'Geography and Economic Development.' *International Regional Science Review* 22(2), 179–232

Goldstein, William M., and Hillel J. Einhorn (1987) 'Expression theory and the preference reversal phenomena.' *Psychological Review* 94(2), 236–254

Gonzalez, Richard, and George Wu (1999) 'On the Shape of the Probability Weighting Function.' *Cognitive Psychology* 38(1), 129–166

Halevy, Yoram (2008) 'Strotz Meets Allais: Diminishing Impatience and the Certainty Effect.' *The American Economic Review* 98(3), 1145–1162

Haushofer, Johannes, and Ernst Fehr (2014) 'On the psychology of poverty.' *Science* 344(6186), 862–867

Henrich, Joseph, Steven J. Heine, and Ara Norenzayan (2010) 'The Weirdest People in the World.' *Behavioral and Brain Sciences*

Hey, John D., and Chris Orme (1994) 'Investigating Generalizations of Expected Utility Theory Using Experimental Data.' *Econometrica* 62(6), 1291–1326

Hofstede, Geert H. (1980) *Culture's consequences : international differences in work- related values* (Thousand Oaks, CA: Sage Publications)

Hopland, Arnt O., Egil Matsen, and Bjarne Strøm (2013) 'Income and choice under risk.' Working Paper Series 14313, Department of Economics, Norwegian University of Science and Technology

Keefer, Philip, and Stephen Knack (1997) 'Why Don't Poor Countries Catch up? a Cross-National Test of an Institutional Explanation.' *Economic Inquiry* 35(3), 590–602

Kilka, Michael, and Martin Weber (2001) 'What Determines the Shape of the Probability Weighting Function under Uncertainty?' *Management Science* 47(12), 1712–1726

Köbberling, Veronika, and Peter P. Wakker (2005) 'An index of loss aversion.' *Journal of Economic Theory* 122(1), 119 – 131

Kőszegi, Botond, and Matthew Rabin (2007) 'Reference-Dependent Risk Attitudes.' *The American Economic Review* 97(4), 1047–1073

List, John A. (2004) 'Neoclassical Theory Versus Prospect Theory: Evidence from the Marketplace.' *Econometrica* 72(2), 615 – 625

Maccini, Sharon, and Dean Yang (2009) 'Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall.' *American Economic Review* 99(3), 1006–1026

Markowitz, Harry (1952) 'The Utility of Wealth.' *Journal of Political Economy* 60(2), 151–158

Niederle, Muriel, and Lise Vesterlund (2007) 'Do Women Shy Away From Competition? Do Men Compete Too Much?' *The Quarterly Journal of Economics* 122(3), 1067–1101

Noussair, Charles N., Stefan T. Trautmann, Gijs van de Kuilen, and Nathanael Vellekoop (2013) 'Risk aversion and religion.' *Journal of Risk and Uncertainty* 47(2), 165–183

Olsson, Ola, and Douglas A. Hibbs (2005) 'Biogeography and long-run economic development.' *European Economic Review* 49, 909–938

Pahlke, Julius, Sebastian Strasser, and Ferdinand M. Vieider (2012) 'Risk-Taking for Others under Accountability.' *Economics Letters* 114(1), 102–105

Peck, Maria Nyström, and Olle Lundberg (1995) 'Short stature as an effect of economic and social conditions in childhood.' *Social Science & Medicine* 41(5), 733–738

Porta, Rafael La, Florencio Lopez-de Silanes, and Andrei Shleifer (2008) 'The Economic Consequences of Legal Origins.' *Journal of Economic Literature* 46(2), 285–332

Prelec, Drazen (1998) 'The Probability Weighting Function.' *Econometrica* 66, 497–527

Preston, Malcolm G., and Philip Baratta (1948) 'An experimental study of the auction-value of an uncertain outcome.' *The American Journal of Psychology* 61, 183–193

Rieger, Marc Oliver, Mei Wang, and Thorsten Hens (2014) 'Risk Preferences Around the World.' *Management Science* 61(3), 637 – 648

Schmidt, Ulrich, and Horst Zank (2007) 'Linear cumulative prospect theory with applications to portfolio selection and insurance demand.' *Decisions in Economics and Finance* 30(1), 1–18

_ (2008) 'Risk Aversion in Cumulative Prospect Theory.' *Management Science* 54(1), 208–216

Schoemaker, Paul J.H. (1990) 'Are Risk-Attitudes Related across Domains and Response Modes?' *Management Science* 36(12), 1451–1463

Starmer, Chris (2000) 'Developments in Non-Expected Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk.' *Journal of Economic Literature* 38, 332–382

Sugden, Robert (2003) 'Reference-dependent subjective expected utility.' *Journal of Economic Theory* 111(2), 172–191

Sutter, Matthias, Martin G Kocher, Daniela Glätzle-Rützler, and Stefan T Trautmann (2013) 'Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior.' *American Economic Review* 103(1), 510–531

Tanaka, Tomomi, Colin F. Camerer, and Quang Nguyen (2010) 'Risk and Time Preferences: Linking Experimental and Household Survey Data from Vietnam.' *American Economic Review* 100(1), 557–571

Train, Kenneth (2009) *Discrete choice methods with simulation* (Cambridge; New York: Cambridge University Press)

Tversky, Amos, and Daniel Kahneman (1992) 'Advances in Prospect Theory: Cumulative Representation of Uncertainty.' *Journal of Risk and Uncertainty* 5, 297–323

Tversky, Amos, and Peter P. Wakker (1995) 'Risk Attitudes and Decision Weights.' *Econometrica* 63(6), 1255–1280

Vieider, Ferdinand M. (2012) 'Moderate stake variations for risk and uncertainty, gains and losses: methodological implications for comparative studies.' *Economics Letters* 117, 718–721

Vieider, Ferdinand M., Abebe Beyene, Randall A. Bluffstone, Sahan Dissanayake, Zenebe Gebreegziabher, Peter Martinsson, and Alemu Mekonnen (2014) 'Measuring risk preferences in Ethiopia: Further evidence on a risk-income paradox, and on risk and religion.' *WZB Working Paper*

Vieider, Ferdinand M., Mathieu Lefebvre, Ranoua Bouchouicha, Thorsten Chmura, Rustamdjan Hakimov, Michal Krawczyk, and Peter Martinsson (2015a) 'Common components of risk and uncertainty attitudes across contexts and domains: Evidence from 30 countries.' *Journal of the European Economic Association* 13(3), 421–452

Vieider, Ferdinand M., Nghi Truong, Peter Martinsson, and Nam Pham Khanh (2013) 'Risk Preferences and Development Revisited.' *WZB Discussion Paper SP II 2013–403*

Vieider, Ferdinand M., Thorsten Chmura, and Peter Martinsson (2012) 'Risk Attitudes, Development, and Growth. Macroeconomic Evidence from Experiments in 30 Countries.' *WZB Working paper*

Vieider, Ferdinand M., Thorsten Chmura, Tylor Fisher, Takao Kusakawa, Peter Martinsson, Frauke Mattison Thompson, and Adewara Sunday (2015b) 'Within- versus Between-Country Differences in Risk Attitudes: Implications for Cultural Comparisons.' *Theory and Decision* 78(2), 209–218

von Gaudecker, Hans-Martin, Arthur van Soest, and Erik Wengström (2011) 'Heterogeneity in Risky Choice Behaviour in a Broad Population.' *American Economic Review* 101(2), 664–694

von Neumann, John, and Oskar Morgenstern (1944) *Theory of Games and Economic Behavior* (New Heaven: Princeton University Press)

Voors, Maarten J., Eleonora E.M. Nillesen, Philip Verwimp, Erwin H. Bulte, Robert Lensink, and Daan P. Van Soest (2012) 'Violent Conflict and Behavior: A Field Experiment in Burundi.' *The American Economic Review* 102(2), 941–964

Vuong, Quang H. (1989) 'Likelihood Ratio Tests for Model Selection and Non-Nested Hypotheses.' *Econometrica* 57(2), 307–333. ArticleType: research-article / Full publication date: Mar., 1989 / Copyright © 1989 The Econometric Society

Wakker, Peter P. (2010) *Prospect Theory for Risk and Ambiguity* (Cambridge: Cambridge University Press)

Weber, Elke U., and Christopher Hsee (1998) 'Cross-Cultural Differences in Risk Perception, but Cross-Cultural Similarities in Attitudes towards Perceived Risk.' *Management Science* 44(9), 1205–1217

Wilcox, Nathaniel T. (2011) ''Stochastically more risk averse:' A contextual theory of stochastic discrete choice under risk.' *Journal of Econometrics* 162(1), 89–104

Wu, George, and Richard Gonzalez (1996) 'Curvature of the Probability Weighting Function.' *Management Science* 42(12), 1676–1690

Yaari, Menahem E. (1987) 'The Dual Theory of Choice under Risk.' *Econometrica* 55(1), 95–115

Zeisberger, Stefan, Dennis Vrecko, and Thomas Langer (2012) 'Measuring the time stability of Prospect Theory preferences.' *Theory and Decision* 72(3), 359–386

APPENDIX FOR ONLINE PUBLICATION

A Country fixed effects

N=2939, $LL = -214,609$	α^+	β^+	α^-	β^-	λ	σ
Australia	-0.077	0.007	-0.102*	-0.106***	-0.115	0.017
	(0.049)	(0.059)	(0.057)	(0.039)	(0.126)	(0.013)
Belgium	-0.010	-0.076*	-0.101*	-0.058	0.057	0.017*
	(0.044)	(0.041)	(0.056)	(0.039)	(0.124)	(0.010)
Brazil	-0.027	-0.174***	-0.029	-0.033	0.127	0.021**
	(0.042)	(0.043)	(0.051)	(0.037)	(0.120)	(0.009)
Cambodia	-0.236***	-0.182***	-0.424***	0.217***	0.902***	0.097***
	(0.060)	(0.047)	(0.071)	(0.057)	(0.231)	(0.009)
Chile	-0.190***	-0.082*	-0.136**	-0.088**	-0.002	0.051***
	(0.049)	(0.048)	(0.054)	(0.044)	(0.109)	(0.010)
China	-0.056	-0.088***	-0.105**	-0.045	0.102	-0.000
	(0.036)	(0.032)	(0.044)	(0.031)	(0.103)	(0.008)
Colombia	-0.095*	-0.116***	-0.075	0.043	0.517***	0.057***
	(0.054)	(0.044)	(0.058)	(0.041)	(0.144)	(0.011)
Costarica	-0.119**	-0.086**	-0.116**	0.047	0.254*	0.072***
	(0.055)	(0.043)	(0.054)	(0.043)	(0.137)	(0.010)
Czech	-0.017	-0.063*	0.010	-0.044	-0.086	-0.022***
	(0.040)	(0.036)	(0.046)	(0.034)	(0.106)	(0.008)
Ethiopia	-0.160***	-0.304***	-0.336***	0.049	0.850***	0.077***
	(0.046)	(0.041)	(0.051)	(0.043)	(0.160)	(0.009)
France	-0.100**	-0.092**	-0.024	-0.010	0.125	0.034***
	(0.046)	(0.045)	(0.052)	(0.043)	(0.117)	(0.009)
Germany	-0.041	0.012	-0.038	-0.015	-0.141	0.024**
	(0.043)	(0.041)	(0.050)	(0.037)	(0.103)	(0.010)
Guatemala	0.049	-0.118**	0.142*	0.190***	0.071	0.088***
	(0.057)	(0.058)	(0.077)	(0.056)	(0.137)	(0.013)
India	-0.290***	-0.072	-0.306***	0.175***	0.912***	0.088***
	(0.054)	(0.051)	(0.062)	(0.052)	(0.230)	(0.010)
Japan	-0.012	-0.095**	0.022	-0.013	0.151	-0.004
	(0.046)	(0.040)	(0.049)	(0.039)	(0.122)	(0.010)
Kyrgyzstan	-0.055	-0.167***	-0.273***	0.063	0.215	0.066***
	(0.053)	(0.042)	(0.060)	(0.046)	(0.140)	(0.009)
Malaysia	-0.070	-0.181***	-0.205***	-0.063	0.599***	0.055***
	(0.055)	(0.050)	(0.068)	(0.054)	(0.218)	(0.012)
Nicaragua	-0.191***	-0.358***	-0.364***	0.052	1.269***	0.167***
	(0.061)	(0.042)	(0.057)	(0.058)	(0.277)	(0.009)
Nigeria	-0.515***	-0.355***	-0.595***	-0.010	1.146***	0.191***
	(0.045)	(0.039)	(0.049)	(0.052)	(0.244)	(0.008)
Peru	-0.222***	-0.315***	-0.275***	-0.000	0.538***	0.110***
	(0.056)	(0.046)	(0.064)	(0.053)	(0.181)	(0.012)
Poland	-0.086*	-0.063	-0.067	0.036	0.111	0.011
	(0.051)	(0.041)	(0.052)	(0.038)	(0.123)	(0.010)
Russia	-0.059	-0.091*	-0.091	0.095**	0.397**	0.021
	(0.048)	(0.047)	(0.057)	(0.047)	(0.194)	(0.013)
Saudi	-0.092*	-0.297***	-0.165***	-0.045	0.529***	0.032***
	(0.054)	(0.044)	(0.063)	(0.045)	(0.171)	(0.011)
South Africa	-0.100*	-0.060	-0.127**	0.055	0.171	0.056***
	(0.051)	(0.051)	(0.062)	(0.055)	(0.143)	(0.013)
Spain	0.023	-0.054	-0.051	-0.042	0.019	0.001
	(0.049)	(0.040)	(0.050)	(0.041)	(0.111)	(0.010)
Thailand	0.037	-0.105**	0.038	0.074	0.383**	0.047***
	(0.056)	(0.051)	(0.057)	(0.048)	(0.161)	(0.010)
Tunisia	-0.246***	-0.169***	-0.329***	0.009	0.470***	0.098***
	(0.058)	(0.050)	(0.069)	(0.058)	(0.172)	(0.011)
UK	0.082	-0.228***	-0.246***	0.101**	1.251***	0.028***
	(0.053)	(0.038)	(0.064)	(0.044)	(0.213)	(0.010)
Vietnam	-0.119**	-0.217***	-0.102*	0.030	0.212*	0.034***
	(0.049)	(0.041)	(0.053)	(0.042)	(0.123)	(0.009)
female	-0.121***	0.041***	-0.090***	-0.043***	-0.030	0.016***
	(0.014)	(0.012)	(0.016)	(0.013)	(0.039)	(0.003)
loss						-0.004**
						(0.002)
constant	0.785***	1.046***	0.870***	0.945***	1.607***	0.156***
	(0.031)	(0.027)	(0.037)	(0.026)	(0.085)	(0.007)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Cultural attitudes and religion

We next look at socio-cultural factors in the determination of risk attitudes. As usual we control for country dummies, as well as the physical factors described above, in all the regressions. We start by considering the cultural attitude scales developed by Hofstede (1980), measured at the individual level in the final questionnaire.[16] The effects are reported in table A.1. Somewhat surprisingly, given discussions in the previous literature (Rieger et al., 2014; Weber and Hsee, 1998), effects seem to range from weak to non-existent. The only effects that are significant at the 5% level is slightly more probabilistic pessimism by subjects ranking high on power distance, and some effects for masculinity. There is, however, also a marginally significant correlation of the risk aversion parameter for gains with uncertainty avoidance, going in the expected direction of more uncertainty avoidance being associated with higher risk aversion.

Table A.1: Effects of cultural characteristics on risk preferences

N=2939, $LL = -214,015$	α^+	β^+	α^-	β^-	λ	σ
individualism	0.002	-0.001	0.001	0.003*	0.005	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.000)
uncertainty avoidance	0.003	0.004*	0.002	0.000	-0.002	0.000
	(0.003)	(0.002)	(0.003)	(0.002)	(0.007)	(0.000)
power distance	-0.002	0.002	-0.003	-0.004**	-0.006	0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.006)	(0.000)
masculinity	0.003	-0.006***	0.001	0.004*	0.013**	-0.001***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.006)	(0.000)
demographics	✓	✓	✓	✓	✓	✓
country fixed effects	✓	✓	✓	✓	✓	✓
constant	0.659***	1.052***	0.844***	0.896***	1.492***	0.163***
	(0.072)	(0.061)	(0.077)	(0.059)	(0.198)	(0.014)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We next discuss the effects of religion, shown in table A.2. The usual caveat of how we can only show correlations—not causal effects—of course continues to apply. However, the religious affiliation we use here—in opposition to the inten-

[16] Examples of questions aimed at detecting the respondents' cultural attitudes are "It is more important for men to have a professional career than it is for women" (masculinity); "Individuals should sacrifice self-interest for the group that they belong to" (individualism); "Standardized work procedures are helpful" (uncertainty avoidance); or "People in lower positions should not disagree with decisions made by people in higher positions" (power distance); a complete list can be found in the instructions. People are asked to indicate on a 5-point scale whether they agree or disagree with the statement.

sity of religious belief often discussed in the literature—is plausibly determined by upbringing. This makes it unlikely that the choice of religious affiliation is determined by risk attitudes, except perhaps for the choice of being atheist. The latter is related with marginally significantly lower levels of noise, but has no significant effects on preference parameters. We cannot replicate previous findings in the literature according to which Catholics are more risk tolerant than Protestants (see Barsky et al., 1997; Noussair et al., 2013, but see also Dohmen et al., 2011 for evidence to the contrary).

Table A.2: Effects of religious affiliation on risk preferences

N=2937, $LL = -213,922$	α^+	β^+	α^-	β^-	λ	σ
atheist	0.033	-0.037	0.050	0.022	0.029	-0.011*
	(0.028)	(0.025)	(0.033)	(0.027)	(0.076)	(0.006)
catholic	0.030	-0.022	0.032	0.017	0.017	-0.004
	(0.030)	(0.028)	(0.034)	(0.029)	(0.081)	(0.006)
orthodox	0.048	0.056	-0.013	0.110**	0.255	0.012
	(0.047)	(0.042)	(0.052)	(0.050)	(0.176)	(0.009)
muslim	0.044	0.003	-0.071	0.042	0.122	0.012
	(0.044)	(0.036)	(0.057)	(0.041)	(0.135)	(0.008)
jewish	-0.060	-0.144**	-0.213**	-0.040	0.362*	-0.003
	(0.089)	(0.061)	(0.087)	(0.067)	(0.214)	(0.019)
hindu	-0.081	0.037	-0.082	0.029	-0.219	-0.008
	(0.083)	(0.067)	(0.084)	(0.077)	(0.225)	(0.016)
buddist	0.023	-0.031	0.032	0.111**	0.109	0.004
	(0.048)	(0.042)	(0.051)	(0.046)	(0.135)	(0.010)
religion_other	0.015	-0.044	-0.018	-0.003	0.055	0.006
	(0.035)	(0.032)	(0.040)	(0.032)	(0.092)	(0.008)
demographics	✓	✓	✓	✓	✓	✓
country fixed effects	✓	✓	✓	✓	✓	✓
constant	0.761***	1.086***	0.865***	0.922***	1.590***	0.165***
	(0.040)	(0.033)	(0.046)	(0.032)	(0.112)	(0.009)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Orthodox participants display increased probabilistic sensitivity for losses relative to the reference group of Protestants, as do Buddhists. The strongest effects, however, are observed for Jews, who are more risk tolerant for gains, less sensitive to probabilistic change for losses, and marginally significantly more loss averse than Protestants. The finding of higher risk tolerance for gains is consistent with the finding for the US by Barsky et al. (1997). One potential explanation is that Jewish families tend on average to be more affluent than the average family, so that the effect we observe for being Jewish is really an income effect. Disentangling this relationship, however, is not possible based on our data alone, and must be left for future research.

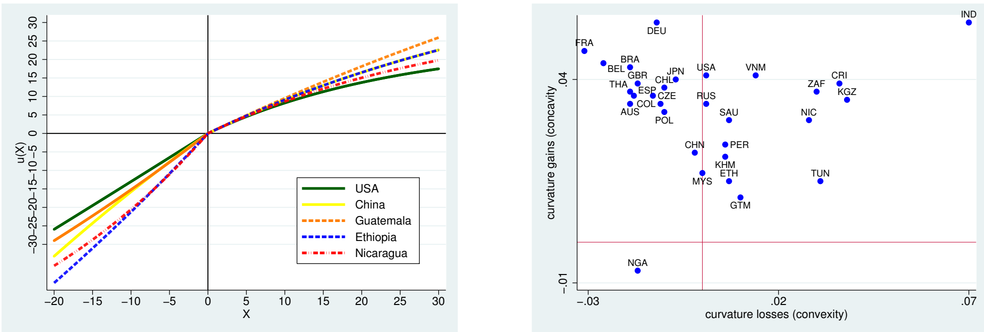
C Full prospect theory specification

Table A.3: Country effects, prospect theory

	utility function			weighting gains		weighting losses	
	μ	ν	λ	α	β	γ	δ
Australia	-0.007	-0.020*	-0.099	-0.094*	0.038	-0.121**	-0.013
	(0.010)	(0.011)	(0.111)	(0.053)	(0.068)	(0.058)	(0.067)
Belgium	0.003	-0.027**	-0.054	-0.011	-0.082	-0.128**	0.068
	(0.009)	(0.010)	(0.107)	(0.050)	(0.050)	(0.057)	(0.069)
Brazil	0.002	-0.020*	0.001	-0.033	-0.160***	-0.050	0.063
	(0.010)	(0.012)	(0.108)	(0.045)	(0.056)	(0.052)	(0.068)
Cambodia	-0.020*	0.005	0.887***	-0.287***	-0.074	-0.420***	0.189**
	(0.010)	(0.016)	(0.220)	(0.066)	(0.055)	(0.071)	(0.095)
Chile	-0.003	-0.011	-0.009	-0.216***	-0.057	-0.147***	-0.036
	(0.009)	(0.011)	(0.098)	(0.054)	(0.058)	(0.054)	(0.067)
China	-0.019***	-0.003	0.194**	-0.096**	0.012	-0.108**	-0.030
	(0.007)	(0.009)	(0.090)	(0.040)	(0.042)	(0.045)	(0.052)
Colombia	-0.007	-0.012	0.443***	-0.115*	-0.071	-0.089	0.102
	(0.009)	(0.012)	(0.143)	(0.063)	(0.050)	(0.061)	(0.070)
Costarica	-0.002	0.035***	0.277**	-0.136**	-0.068	-0.067	-0.111*
	(0.009)	(0.011)	(0.117)	(0.061)	(0.057)	(0.057)	(0.062)
Czech	-0.005	-0.014	-0.089	-0.032	-0.035	-0.006	0.023
	(0.008)	(0.009)	(0.092)	(0.044)	(0.044)	(0.047)	(0.055)
Ethiopia	-0.026***	0.006	0.921***	-0.218***	-0.159***	-0.330***	0.020
	(0.008)	(0.010)	(0.151)	(0.050)	(0.048)	(0.051)	(0.065)
France	0.006	-0.032***	-0.017	-0.102**	-0.106**	-0.059	0.149**
	(0.010)	(0.012)	(0.108)	(0.052)	(0.052)	(0.052)	(0.073)
Germany	0.013	-0.013	-0.205**	-0.023	-0.046	-0.053	0.046
	(0.009)	(0.010)	(0.085)	(0.049)	(0.051)	(0.050)	(0.060)
Guatemala	-0.030***	0.009	0.286**	0.000	0.035	0.160**	0.143
	(0.010)	(0.013)	(0.146)	(0.061)	(0.072)	(0.077)	(0.089)
India	0.013	0.069***	0.614***	-0.308***	-0.116**	-0.211***	-0.134*
	(0.012)	(0.015)	(0.166)	(0.061)	(0.055)	(0.067)	(0.073)
Japan	-0.001	-0.008	0.088	-0.018	-0.079*	0.013	0.023
	(0.009)	(0.011)	(0.110)	(0.049)	(0.048)	(0.051)	(0.066)
Kyrgyzstan	-0.006	0.037**	0.296***	-0.077	-0.120**	-0.229***	-0.106
	(0.009)	(0.015)	(0.115)	(0.059)	(0.055)	(0.064)	(0.076)
Malaysia	-0.024***	-0.001	0.661***	-0.118**	-0.055	-0.206***	-0.060
	(0.009)	(0.013)	(0.198)	(0.059)	(0.062)	(0.068)	(0.093)
Nicaragua	-0.011	0.027*	1.065***	-0.239***	-0.269***	-0.338***	-0.076
	(0.010)	(0.014)	(0.235)	(0.066)	(0.056)	(0.061)	(0.084)
Nigeria	-0.048***	-0.018	1.500***	-0.595***	-0.114**	-0.606***	0.076
	(0.009)	(0.013)	(0.276)	(0.047)	(0.055)	(0.049)	(0.081)
Peru	-0.017*	0.005	0.543***	-0.270***	-0.203***	-0.270***	-0.025
	(0.010)	(0.013)	(0.161)	(0.062)	(0.056)	(0.066)	(0.080)
Poland	-0.009	-0.011	0.119	-0.110**	-0.014	-0.081	0.091
	(0.009)	(0.010)	(0.106)	(0.053)	(0.052)	(0.053)	(0.064)
Russia	-0.007	0.000	0.353**	-0.079	-0.048	-0.090	0.092
	(0.009)	(0.012)	(0.155)	(0.052)	(0.057)	(0.059)	(0.073)
Saudi	-0.011	0.006	0.493***	-0.126**	-0.213***	-0.158**	-0.072
	(0.009)	(0.013)	(0.169)	(0.060)	(0.053)	(0.064)	(0.067)
Southafrica	-0.004	0.029**	0.224*	-0.118**	-0.032	-0.087	-0.079
	(0.010)	(0.014)	(0.122)	(0.057)	(0.065)	(0.064)	(0.082)
Spain	-0.005	-0.019*	-0.006	0.012	-0.025	-0.072	0.047
	(0.008)	(0.011)	(0.099)	(0.053)	(0.049)	(0.050)	(0.062)
Thailand	-0.004	-0.020	0.273*	0.028	-0.078	0.012	0.173**
	(0.011)	(0.013)	(0.151)	(0.064)	(0.061)	(0.059)	(0.087)
Tunisia	-0.026**	0.030**	0.633***	-0.302***	-0.033	-0.298***	-0.125
	(0.010)	(0.014)	(0.170)	(0.062)	(0.063)	(0.073)	(0.080)
UK	-0.002	-0.018	0.943***	0.072	-0.189***	-0.265***	0.192***
	(0.009)	(0.011)	(0.179)	(0.060)	(0.047)	(0.063)	(0.072)
Vietnam	0.000	0.013	0.171	-0.138**	-0.188***	-0.085	-0.033
	(0.010)	(0.012)	(0.118)	(0.054)	(0.054)	(0.056)	(0.073)
female	0.011***	0.003	-0.074*	-0.112***	-0.011	-0.085***	-0.054**
	(0.003)	(0.004)	(0.040)	(0.015)	(0.017)	(0.016)	(0.025)
constant (USA)	0.041***	0.001	1.310***	0.858***	0.834***	0.871***	0.939***
	(0.006)	(0.007)	(0.066)	(0.035)	(0.036)	(0.038)	(0.044)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

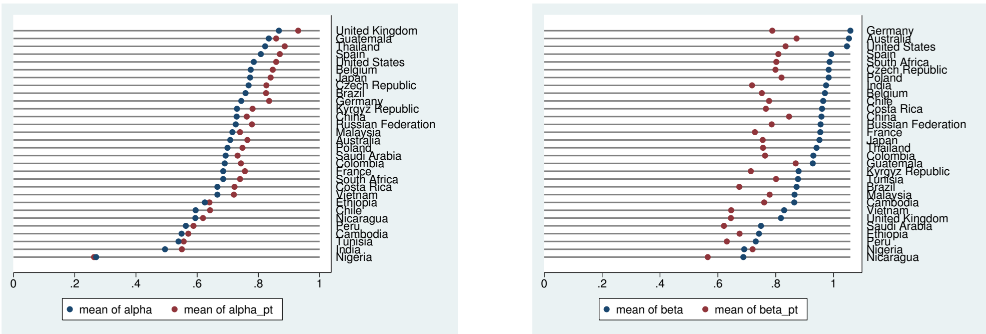
Table A.3 shows the regression on country dummies of the full prospect theory model. The model is constituted by the model presented in the text, plus a value function that takes the form $v(x) = \frac{1-e^{-\mu x}}{\mu}$ for gains and $v(x) = -\lambda \frac{1-e^{-\nu(-x)}}{\nu}$ for losses. We use an exponential form since this reduces collinearity between utility and weighting in our setup. For an easier representation of the parameters, figure A.1 shows some typical utility functions (panel 1(a)), as well as a scatter plot of the utility curvature parameters for gains and losses (panel 1(b)). For gains, we almost universally find slightly concave utility, with the exception of Nigeria, where utility is somewhat convex (although not significantly so). For losses the patterns are more varied, with convex, linear, and concave utility all occurring in the data.



(a) Typical utility functions (b) Scatter plot of parameters

Figure A.1: Probability weighting functions for gains

Figure A.2 plots the parameters of the probability weighting function for gains under the full prospect theory model against those obtained for our main model assuming linear utility. We have seen above that, except for Nigeria, all utility functions tend towards concavity for gains. This is reflected in very regular changes in the weighting function parameters relative to those shown in the main text. Panel 2(a) shows the changes undergone by the sensitivity parameter α^+. The sensitivity parameter becomes slightly larger for all countries but Nigeria once we allow for utility curvature. Furthermore, the two values of the sensitivity parameter we observe for the prospect theory model and the linear model are highly correlated at $r = 0.993, p < 0.001$. We observe similarly regular changes for the elevation parameter β^+, shown in panel 2(b). Allowing for utility curvature reduces the value of β^+ in all cases (again with the exception of Nigeria). This is indeed to be expected, since part of the risk aversion is now picked up in utility curvature. This is shown clearly when one correlates the difference between the two elevation parameters obtained under the two models and the utility curvature parameter. The resulting correlation is $r = 0.988, p < 0.001$, showing a direct relationship between the risk aversion picked up by the utility function and the amount of risk aversion lost in the elevation parameter. The elevation parameters under the different models are highly correlated at $r = 0.79, p < 0.001$.



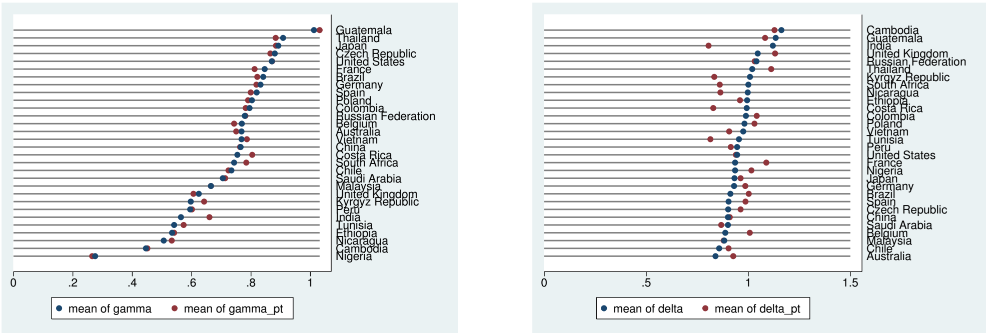
(a) Parameter comparison alpha

(b) Parameter comparison beta

Figure A.2: Probability weighting functions for gains, parameter comparison

We next look at the corresponding parameters for losses, represented in figure A.3. Differences in terms of the sensitivity parameter, shown in panel 3(a), are relatively small. They now go in both directions, reflecting the less regular patterns seen for the utility functions. A similar conclusion holds for the elevation parameter, shown in panel 3(b). Here the elevation parameters differ in both directions from the parameters estimated using linear utility. Once again, we find these deviations to be highly correlated with the utility parameter for losses at $r = 0.999, p < 0.001$. The more diverse pattern, however, means that we do not find a strong correlation between the two elevation parameters estimated under the different models for losses ($r = 0.275, p = 0.142$). We also observe high degrees of collinearity between the utility parameter and the weighting function elevation parameter even for this relatively simple model, with a correlation of

$r = -0.699, p < 0.001$. Given this state of affairs, where changes in utility correlate highly with inverse changes in the elevation parameter, and utility and the elevation parameter in the full model are highly collinear for losses, we feel justified in employing the simplifying assumption of linear utility.



(a) Typical utility functions

(b) Scatter plot of parameters

Figure A.3: Probability weighting functions for losses, parameter comparison

D Stability of income correlations

In this section we add a number of potential explanatory macroeconomic variables to the GDP variable in order to test for the stability of the latter. We take these variables from the macroeconomics literature on growth and comparative development. We start by inserting geographical variables, in particular, distance from the equator in degrees (60nm), a dummy indicating whether a country is landlocked, and continent dummies. The results are shown in table A.4. First and foremost, all the effects discussed in the main text remain highly significant. In addition, latitude also shows some significant effects, going in the direction of participants at higher latitudes showing less noisy behavior, lower loss aversion, and higher degrees of risk aversion for gains.

Table A.4: Effects of income measures on risk preferences, geographical controls

N=2939, $LL = -215,871$	α^+	β^+	α^-	β^-	λ	σ
GDP (diff. from US)	-0.062***	-0.054***	-0.122***	0.046***	0.166***	0.036***
	(0.014)	(0.012)	(0.015)	(0.012)	(0.039)	(0.003)
latitude (degrees)	-0.000	0.001**	-0.001	-0.000	-0.007***	-0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
landlocked	0.116***	0.012	0.137***	-0.042*	-0.254***	-0.049***
	(0.028)	(0.022)	(0.029)	(0.022)	(0.073)	(0.005)
foreigner	0.028	-0.002	0.002	0.029	0.027	0.015**
	(0.033)	(0.030)	(0.039)	(0.028)	(0.086)	(0.007)
Gini difference	0.472***	0.250**	0.604***	0.158	-0.452	-0.126***
	(0.118)	(0.112)	(0.134)	(0.111)	(0.374)	(0.027)
private university	0.011	-0.073***	-0.061**	-0.032	0.068	0.005
	(0.026)	(0.023)	(0.031)	(0.025)	(0.085)	(0.006)
OPEC	-0.219***	-0.163***	-0.215***	-0.053	0.335**	0.052***
	(0.034)	(0.029)	(0.037)	(0.036)	(0.140)	(0.006)
Africa	-0.126***	0.032	-0.081*	-0.066*	-0.077	0.011
	(0.040)	(0.035)	(0.046)	(0.035)	(0.116)	(0.009)
Asia	-0.010	0.035	0.011	-0.053**	-0.187**	-0.028***
	(0.029)	(0.027)	(0.033)	(0.025)	(0.081)	(0.007)
Americas	-0.092***	-0.015	-0.042	-0.061**	-0.162*	0.017**
	(0.035)	(0.031)	(0.041)	(0.030)	(0.094)	(0.007)
Oceania	-0.042	0.092*	-0.050	-0.098***	-0.360***	-0.007
	(0.043)	(0.055)	(0.049)	(0.034)	(0.113)	(0.012)
female	-0.122***	0.047***	-0.099***	-0.035***	-0.019	0.020***
	(0.014)	(0.013)	(0.016)	(0.013)	(0.041)	(0.003)
loss						-0.002
						(0.002)
constant	0.840***	0.951***	0.982***	0.949***	2.001***	0.169***
	(0.051)	(0.042)	(0.059)	(0.044)	(0.142)	(0.009)

* (p<0.10), ** (p<0.05), *** (p<0.01)

We next take a look at genetic diversity within a country, which has been found to relate significantly to GDP per capita (Ashraf and Galor, 2013). We use the predicted genetic diversity measures from that paper. The results are shown in table A.5. Once again, the main effects discussed in the paper remain stable. The genetic diversity measures show some additional effects, most notably on losses, loss aversion, and on noise—although they have no effect on gains.

Table A.5: Effects of income measures on risk preferences, genetic diversity

N=2939, $LL = -215,978$	α^+	β^+	α^-	β^-	λ	σ
GDP diff. from US	-0.057***	-0.056***	-0.121***	0.042***	0.168***	0.037***
	(0.014)	(0.013)	(0.016)	(0.013)	(0.048)	(0.003)
predicted diversity	0.443	1.699	-14.664**	14.552**	42.421**	8.152***
	(6.531)	(5.780)	(7.025)	(6.154)	(19.425)	(1.321)
pr. diversity sqaured	1.328	-0.685	12.374**	-9.805**	-31.908**	-6.506***
	(4.889)	(4.312)	(5.252)	(4.639)	(15.052)	(0.992)
OPEC	-0.285***	-0.185***	-0.290***	-0.075*	0.410**	0.084***
	(0.037)	(0.031)	(0.038)	(0.042)	(0.167)	(0.007)
private university	0.022	-0.072***	-0.073**	-0.011	0.108	0.013**
	(0.030)	(0.025)	(0.034)	(0.027)	(0.087)	(0.006)
foreigner	0.008	-0.010	-0.016	0.016	0.016	0.019***
	(0.034)	(0.031)	(0.040)	(0.029)	(0.083)	(0.007)
Gini difference	0.417***	0.247**	0.527***	0.253**	-0.120	-0.092***
	(0.115)	(0.111)	(0.132)	(0.110)	(0.382)	(0.027)
degrees latitude	-0.000	0.001*	-0.001	-0.001	-0.008***	-0.000***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.000)
Africa	-0.143***	0.028	-0.109**	-0.083**	-0.075	0.018*
	(0.042)	(0.036)	(0.048)	(0.037)	(0.123)	(0.009)
Asia	0.052	0.058*	0.105**	-0.052	-0.316***	-0.067***
	(0.037)	(0.033)	(0.042)	(0.033)	(0.118)	(0.008)
Americas	0.170**	0.080	0.185**	0.098	-0.217	-0.051***
	(0.070)	(0.058)	(0.080)	(0.063)	(0.212)	(0.016)
Oceania	0.142**	0.154**	0.138*	-0.004	-0.445**	-0.070***
	(0.064)	(0.069)	(0.072)	(0.055)	(0.198)	(0.016)
female	-0.124***	0.050***	-0.099***	-0.029**	-0.017	0.020***
	(0.014)	(0.013)	(0.016)	(0.013)	(0.042)	(0.003)
loss						-0.003
						(0.002)
constant	-0.191	0.081	5.093**	-4.420**	-11.931*	-2.315***
	(2.194)	(1.949)	(2.364)	(2.050)	(6.276)	(0.443)

* (p<0.10), ** (p<0.05), *** (p<0.01)

We next look at legal origins (Porta et al., 2008). The regression is shown in table A.6. Once again, we conclude that our main variables remain highly significant. Some of the legal origins dummies show significant results. However, these results do not appear to be systematic in the sense of affecting several parameters in a consistent fashion. Also, since there are very few countries in each categories, the variables risk picking up country fixed effects instead of actual effects of legal origins.

Table A.6: Effects of income measures on risk preferences, legal origins

N=2939, $LL = -216,165$	α^+	β^+	α^-	β^-	λ	σ
GDP diff. from US	-0.059***	-0.059***	-0.101***	0.035***	0.212***	0.036***
	(0.008)	(0.007)	(0.009)	(0.007)	(0.028)	(0.002)
legor UK	-0.004	-0.034	-0.118***	0.017	0.316***	0.012*
	(0.029)	(0.029)	(0.032)	(0.026)	(0.081)	(0.007)
legor French	-0.031	-0.068**	-0.066**	-0.021	0.141**	0.019***
	(0.028)	(0.027)	(0.030)	(0.025)	(0.069)	(0.007)
legor Socialist	0.023	-0.011	-0.022	-0.012	-0.021	-0.035***
	(0.028)	(0.028)	(0.029)	(0.024)	(0.073)	(0.007)
OPEC	-0.264***	-0.162***	-0.206***	-0.079**	0.251*	0.054***
	(0.035)	(0.028)	(0.036)	(0.036)	(0.149)	(0.007)
private university	0.031	-0.052**	-0.029	-0.039	0.030	-0.012**
	(0.027)	(0.022)	(0.032)	(0.025)	(0.081)	(0.005)
foreigner	0.023	0.000	-0.009	0.024	0.006	0.015**
	(0.033)	(0.030)	(0.040)	(0.029)	(0.085)	(0.007)
Gini difference	0.153*	0.143**	0.490***	0.059	-0.397	-0.043**
	(0.084)	(0.072)	(0.091)	(0.077)	(0.256)	(0.021)
female	-0.127***	0.046***	-0.100***	-0.032**	-0.025	0.020***
	(0.014)	(0.013)	(0.016)	(0.013)	(0.042)	(0.003)
loss						-0.002
						(0.002)
constant	0.791***	1.048***	0.959***	0.920***	1.458***	0.149***
	(0.026)	(0.026)	(0.027)	(0.023)	(0.068)	(0.007)

* (p<0.10), ** (p<0.05), *** (p<0.01)

Finally, we can take a look at institutional quality (Keefer and Knack, 1997). The results are shown in table A.7. The institutional variable is the first principal component of the five governance indicators used in the cited paper, voice and accountability, political stability, government effectiveness, regulatory quality, and the rule of law. Once again, the effects found previously are largely stable. The one and only exception to this rule is risk seeking for losses, which now no longer shows a significant correlation with the GDP per capita measure. This is likely due to the very high correlation between the GDP difference measure and the institutional indicator ($r = -0.890, p < 0.001$). The institutional measure itself mostly shows effects on the rationality parameters, with sensitivity decreasing and noise increasing for higher institutional quality—holding GDP per capita constant.

Overall, the picture is thus quite clear. While some of the additional controls explored here show some effects, they are generally of second order compared

Table A.7: Effects of income measures on risk preferences, institutions

N=2939, $LL = -216,980$	α^+	β^+	α^-	β^-	λ	σ
GDP diff. from US	-0.091***	-0.056***	-0.120***	0.010	0.157***	0.045***
	(0.016)	(0.015)	(0.017)	(0.015)	(0.054)	(0.004)
institutional quality	-0.020**	0.004	-0.015	-0.012	-0.022	0.007***
	(0.009)	(0.008)	(0.010)	(0.008)	(0.029)	(0.002)
OPEC	-0.285***	-0.140***	-0.286***	-0.070*	0.402***	0.072***
	(0.033)	(0.027)	(0.033)	(0.036)	(0.152)	(0.006)
private university	0.007	-0.063***	-0.052	-0.045*	0.085	0.002
	(0.027)	(0.022)	(0.032)	(0.025)	(0.080)	(0.005)
foreigner	0.026	0.000	-0.005	0.026	-0.001	0.018**
	(0.034)	(0.030)	(0.040)	(0.029)	(0.081)	(0.007)
Gini difference	0.053	0.109	0.357***	0.044	-0.168	0.030
	(0.090)	(0.078)	(0.097)	(0.082)	(0.253)	(0.020)
female	-0.122***	0.046***	-0.098***	-0.029**	-0.019	0.020***
	(0.014)	(0.013)	(0.016)	(0.013)	(0.042)	(0.003)
loss						-0.003
						(0.002)
constant	0.832***	1.003***	0.928***	0.950***	1.666***	0.138***
	(0.026)	(0.024)	(0.029)	(0.024)	(0.090)	(0.008)

* (p<0.10), ** (p<0.05), *** (p<0.01)

to the ones shown by GDP per capita. The last remains strong and strongly significant throughout—a good indication that there ought indeed to be a direct connection.

E Correlation between pooled estimates and random effects

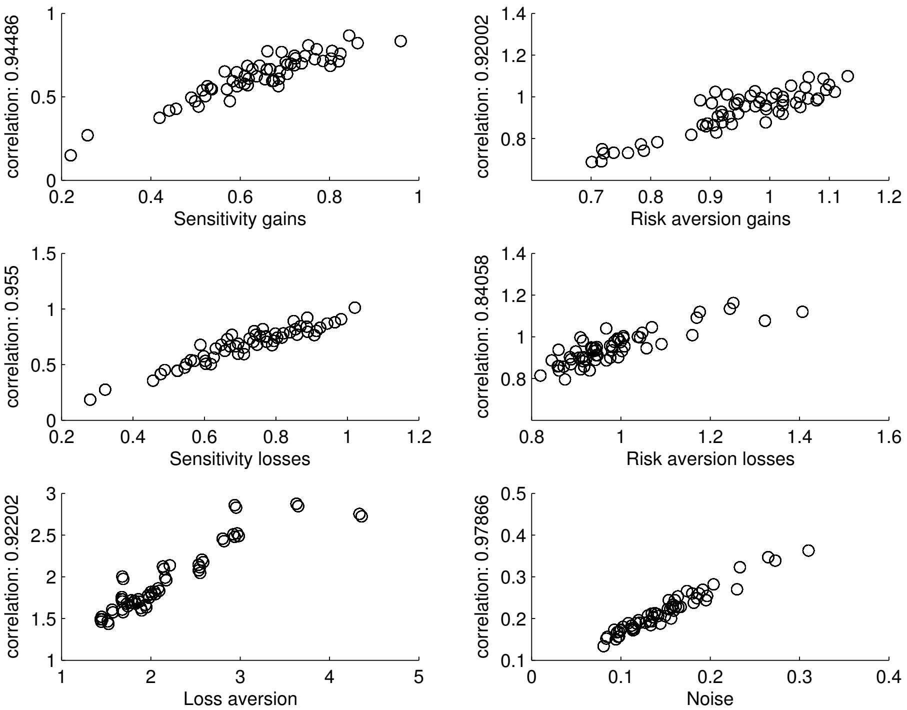


Figure A.4: Correlation between pooled estimates and random effects: country dummies

F Full-lenght instructions (English)

Below we include the full-length instructions in English, with amounts in Euros. Instructions in other languages can be downloaded at www.ferdinandvieider.com/instructions.html

Instructions

Thank you for participating in this experiment in decision making! You will obtained 4 Euros for having come to the experiment—those 4 Euros are yours to keep independently of the outcomes in the experiment. In addition, you will be compensated with whatever you earn during the experiment according to the procedures described in the instructions.

The instructions will be read to you in a short while. You may consult these instructions at any time during the experiment. In case you should have any questions or doubts, please raise your hand and an experimenter will come and assist you in private.

Please consider each decision carefully. Take a careful look at outcomes and the probabilities associated to them before taking a decision. Remember that your final payoffs from this experiment will depend on the decisions you make (and of course, on chance).

Please remain seated when you are finished with the tasks. This experiment consists of two parts. Once everybody has finished the tasks in part I, new instructions will be read to you for part II. At the very end of the experiment, you will be asked to fill out a questionnaire. The answer to the questionnaire as well as all your answers to the tasks will be private, and cannot be traced back to you personally. Once you are done filling in the questionnaire, an experimenter will call you up. Your payoff will then be determined in private, you will be given the money you won, after which you can leave.

Do not talk during the experiment, or you will be immediately excluded from the experiment !

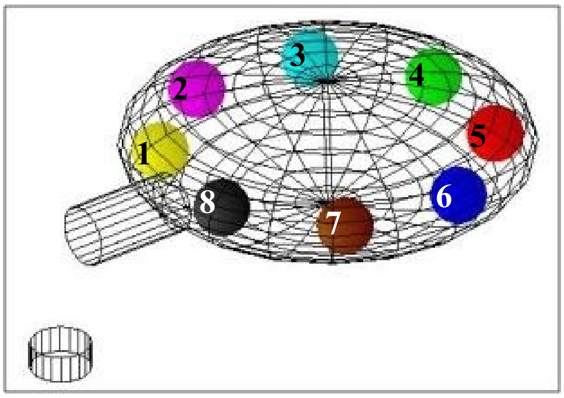
Good luck!

PART I

Choice tasks
In the present experiment, you will be asked to choose repeatedly between a fixed amount of money and a lottery. The lottery will always give you a chance to win one of two amounts of money. Figure 1 shows a typical choice task. You are asked repeatedly to choose between playing the lottery and obtaining a sure amount of money. **For each row**, you are asked to indicate whether you would prefer to play the lottery or to obtain the sure amount of money by ticking the preferred option.

The urn indicated in the figure contains eight numbered balls. One ball will be extracted from the urn to determine your payoffs in case you should play the lottery. In the lottery displayed, if ball 1 , 2 , 3, or 4 is extracted, you obtain €10; if ball 5 , 6 , 7 , 8 is extracted, you obtain nothing. Please pay close attention to the amounts to be won as well as the number of balls associated with each outcome, since they change across decisions.

Fig. 1: Example of a typical decision task

	Lottery	Sure amount	
	O	O	€ 0.50 for sure
	O	O	€ 1.00 for sure
	O	O	€ 1.50 for sure
	O	O	€ 2.00 for sure
	O	O	€ 2.50 for sure
	O	O	€ 3.00 for sure
	O	O	€ 3.50 for sure
	O	O	€ 4.00 for sure
	O	O	€ 4.50 for sure
Win € **10** if one of the following balls is extracted:	O	O	€ 5.00 for sure
1 2 3 4	O	O	€ 5.50 for sure
	O	O	€ 6.00 for sure
	O	O	€ 6.50 for sure
Win € **0** if one of the following balls is extracted:	O	O	€ 7.00 for sure
5 6 7 8	O	O	€ 7.50 for sure
	O	O	€ 8.00 for sure
	O	O	€ 8.50 for sure
	O	O	€ 9.00 for sure
	O	O	€ 9.50 for sure

We are interested in the amount for which you will switch from preferring the lottery to preferring the sure amount. Most likely, you will begin by choosing the lottery for small sure amounts, and at a certain point switch to the sure amount as the latter increases. If you do not want the lottery at all, you can choose to get the sure amount in the first row and then continue with the sure amount for all choices (if you prefer €0.50 over the lottery you should also prefer €1.00 over the lottery, etc.). Where you will switch from the lottery to the sure amount depends entirely on your preferences—there are no right or wrong answers. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example, if you have not ticked any box for a given row or ticked both boxes for a given row).

Types of choices
You will be asked to take 18 decisions, for each one of which you will need to decide between a lottery and a series of sure amounts as exemplified in figure 1 above. **Please pay close attention to the amounts to be won as well as the number of balls associated with each outcome!** Indeed, both the higher and lower amount, as well as the number of balls, change between decision problems. Since your final payoff depends on these decisions, it is crucial for you to pay close attention to these features.

There are **two different types of lotteries** involved. Figure 2 below shows the two different types of lotteries that you will encounter. Fig 2a shows the urn already familiar from figure 1 above. It contains exactly eight (8) balls, numbered from 1 to 8.

In Urn in Fig. 2b also contains exactly eight (8) balls. However, you cannot see what numbers the balls contained in the urn have. This means that **you do not know the exact numbers that are present in that urn**. All balls bear a number between 1 and 8 inclusive (have either 1 , 2 , 3 , 4 , 5 , 6 , 7 , or 8 written on them), but it is possible that some numbers are absent from this urn while others occur repeatedly. Thus you do not know the exact composition of the urn.

Fig. 2a: transparent urn

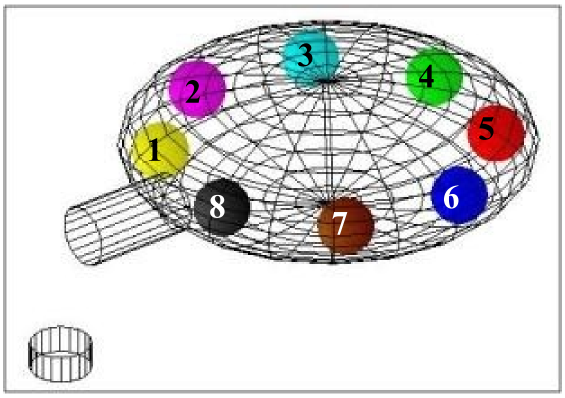
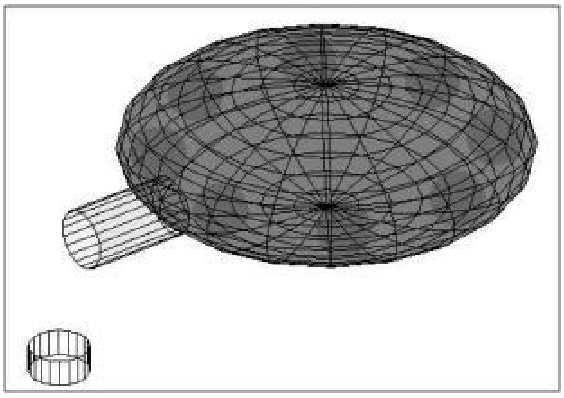


Fig. 2b: opaque urn

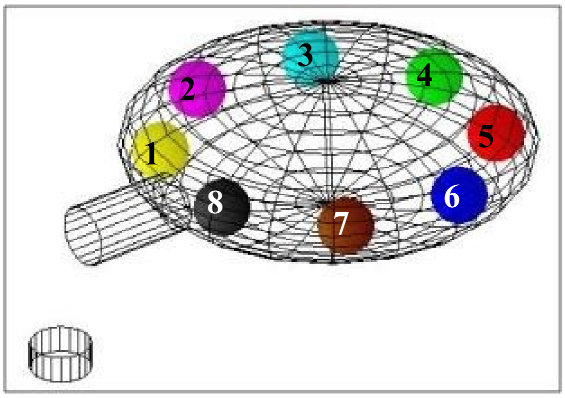


Payoff determination
After you have taken all the decisions, one of your decisions will be randomly drawn for real pay, i.e. **the amounts indicated in the decision problem will be paid out for real**. First, either part I or part II will be selected for real play by a coin flip. If part I is selected, then one of the 18 decision tasks is drawn at random, using a chance device with equal probability for each decision task to be extracted. For the extracted decision task, one of your decisions, corresponding to one row for which you had to indicate your preference between the sure amount and the lottery, will then be drawn at random with **equal probability for each row**. If for the row that is drawn you have indicated that you prefer the sure amount of money, you will simply be paid that amount.

In case you have chosen the lottery for the randomly determined row, then that lottery will be played according to the probabilities indicated. For the transparent urn, this will involve drawing a ball from an urn in which all numbers from 1 to 8 inclusive are present. If you should desire to do so, you can verify that there are indeed all balls from 1 to 8 in the urn. You will then be paid the outcome corresponding to the ball you drew.

For the opaque urn, the procedure is exactly analogous, except that you will now draw a ball from a pre-composed urn, the exact composition of which you do not know. You will also be paid the outcome corresponding to the ball you drew. If you should desire to do so, after the draw you can verify that there are indeed 8 balls with numbers between 1 and 8 inclusive in the urn.

Decision 1



Win € **5** if one of the following balls is extracted:

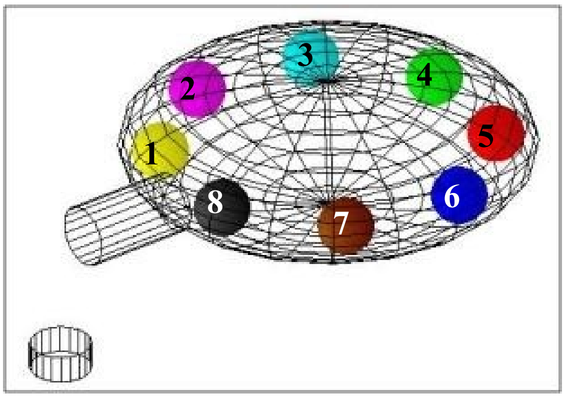
1 2 3 4

Win € **0** if one of the following balls is extracted:

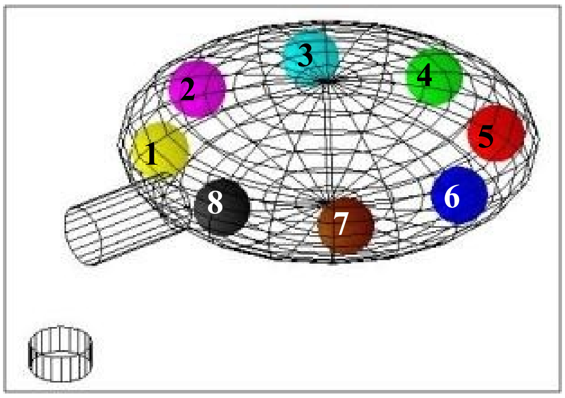
5 6 7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure

Decision 2

	Lottery	Sure	
	O	O	€ 0.50 for sure
	O	O	€ 1.00 for sure
	O	O	€ 1.50 for sure
	O	O	€ 2.00 for sure
	O	O	€ 2.50 for sure
	O	O	€ 3.00 for sure
	O	O	€ 3.50 for sure
	O	O	€ 4.00 for sure
	O	O	€ 4.50 for sure
	O	O	€ 5.00 for sure
	O	O	€ 5.50 for sure
	O	O	€ 6.00 for sure
	O	O	€ 6.50 for sure
Win **€ 10** if one of the following balls is extracted:	O	O	€ 7.00 for sure
1 2 3 4	O	O	€ 7.50 for sure
	O	O	€ 8.00 for sure
Win **€ 0** if one of the following balls is extracted:	O	O	€ 8.50 for sure
5 6 7 8	O	O	€ 9.00 for sure
	O	O	€ 9.50 for sure

Decision 3



Win **€ 20** if one of the following balls is extracted:

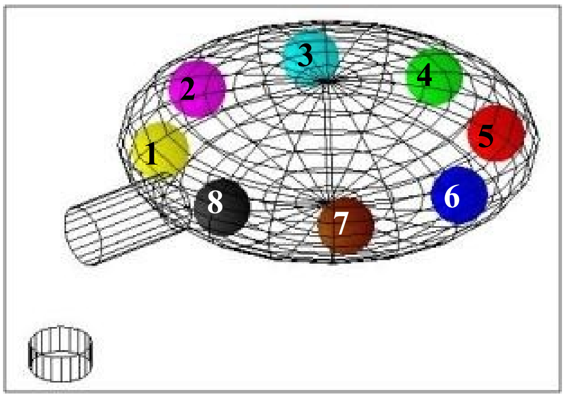
1 **2** **3** **4**

Win **€ 0** if one of the following balls is extracted:

5 **6** **7** **8**

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 4



Win **€ 30** if one of the following balls is extracted:

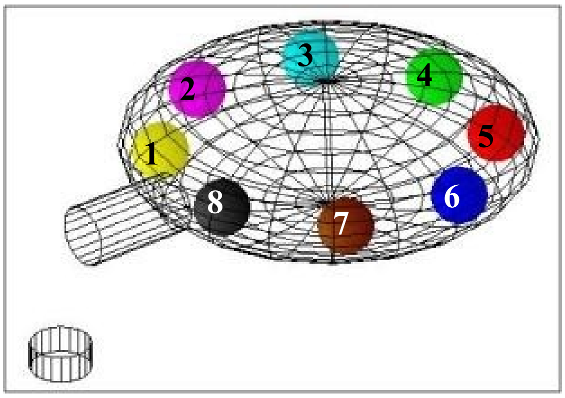
1 **2** **3** **4**

Win **€ 0** if one of the following balls is extracted:

5 **6** **7** **8**

Lottery	Sure	
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure
O	O	€ 20.00 for sure
O	O	€ 20.50 for sure
O	O	€ 21.00 for sure
O	O	€ 21.50 for sure
O	O	€ 22.00 for sure
O	O	€ 22.50 for sure
O	O	€ 23.00 for sure
O	O	€ 23.50 for sure
O	O	€ 24.00 for sure
O	O	€ 24.50 for sure

Decision 5



Win € **30** if one of the following balls is extracted:

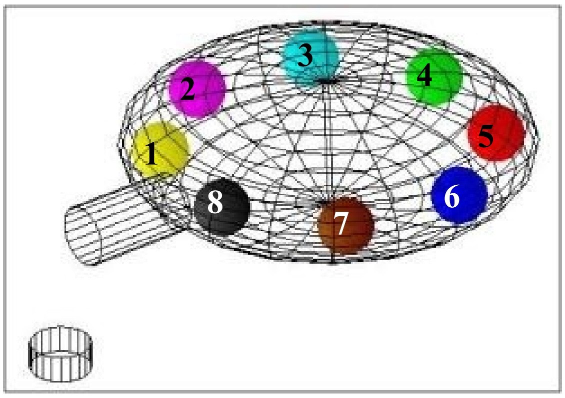
1 2 3 4

Win € **10** if one of the following balls is extracted:

5 6 7 8

Lottery	Sure	
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure
O	O	€ 20.00 for sure
O	O	€ 20.50 for sure
O	O	€ 21.00 for sure
O	O	€ 21.50 for sure
O	O	€ 22.00 for sure
O	O	€ 22.50 for sure
O	O	€ 23.00 for sure
O	O	€ 23.50 for sure
O	O	€ 24.00 for sure
O	O	€ 24.50 for sure
O	O	€ 25.00 for sure
O	O	€ 25.50 for sure
O	O	€ 26.00 for sure
O	O	€ 26.50 for sure
O	O	€ 27.00 for sure
O	O	€ 27.50 for sure
O	O	€ 28.00 for sure
O	O	€ 28.50 for sure
O	O	€ 29.00 for sure
O	O	€ 29.50 for sure

Decision 6



Win € **30** if one of the following balls is extracted:

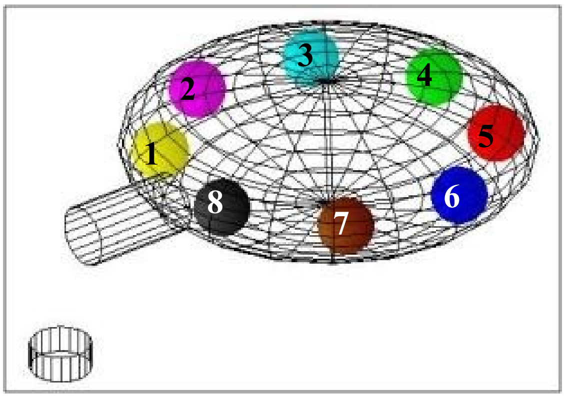
1 2 3 4

Win € **20** if one of the following balls is extracted:

5 6 7 8

Lottery	Sure	
O	O	€ 20.50 for sure
O	O	€ 21.00 for sure
O	O	€ 21.50 for sure
O	O	€ 22.00 for sure
O	O	€ 22.50 for sure
O	O	€ 23.00 for sure
O	O	€ 23.50 for sure
O	O	€ 24.00 for sure
O	O	€ 24.50 for sure
O	O	€ 25.00 for sure
O	O	€ 25.50 for sure
O	O	€ 26.00 for sure
O	O	€ 26.50 for sure
O	O	€ 27.00 for sure
O	O	€ 27.50 for sure
O	O	€ 28.00 for sure
O	O	€ 28.50 for sure
O	O	€ 29.00 for sure
O	O	€ 29.50 for sure

Decision 7



Win € **20** if one of the following balls is extracted:

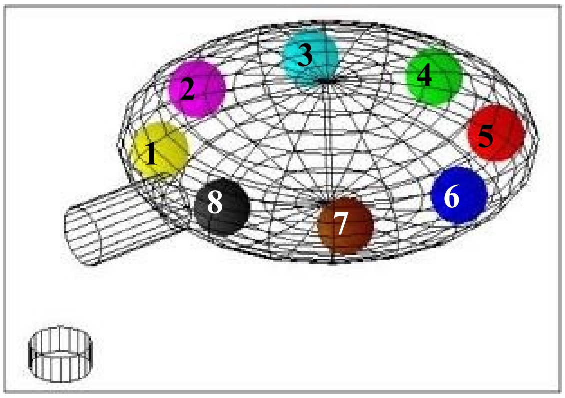
1

Win € **0** if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 8



Win € **20** if one of the following balls is extracted:

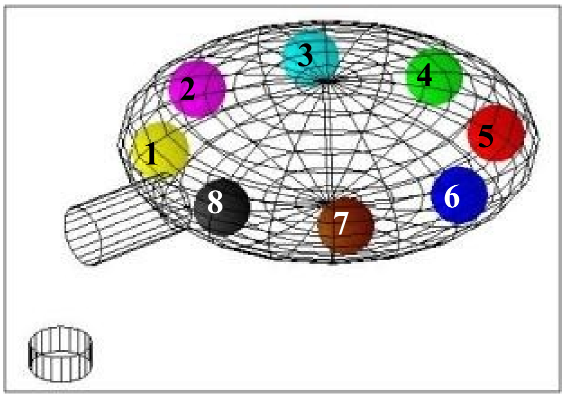
1

Win € **5** if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 9



Win € **20** if one of the following balls is extracted:

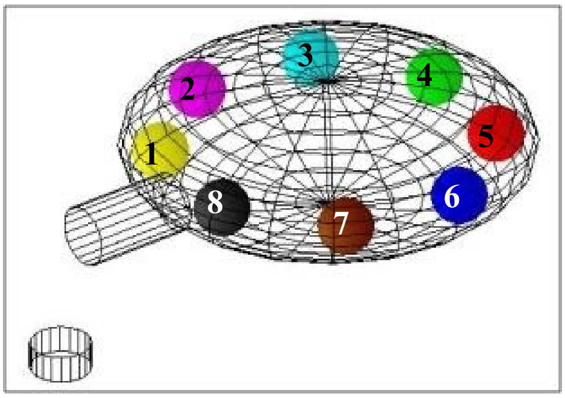
1 **2**

Win € **0** if one of the following balls is extracted:

3 **4** **5** **6** **7** **8**

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 10



Win € **20** if one of the following balls is extracted:

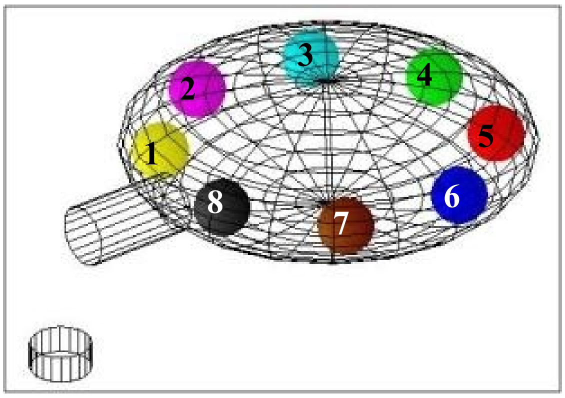
1 2 3

Win € **0** if one of the following balls is extracted:

4 5 6 7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 11



Win **€ 20** if one of the following balls is extracted:

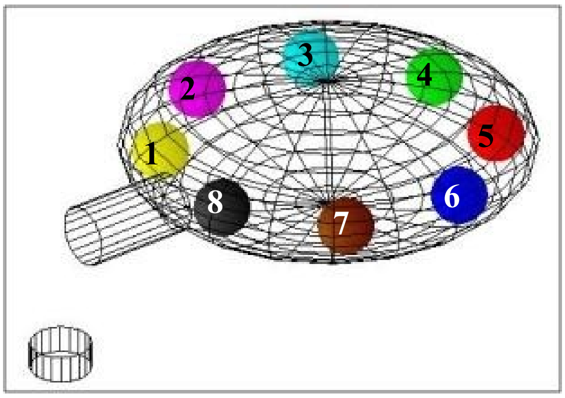
1 **2** **3** **4** **5**

Win **€ 0** if one of the following balls is extracted:

6 **7** **8**

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 12



Win **€ 20** if one of the following balls is extracted:

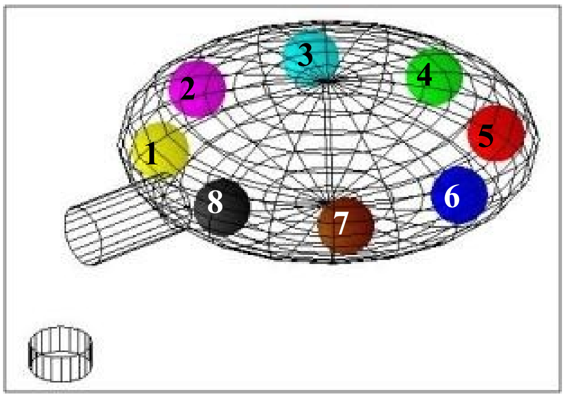
1 2 3 4 5 6

Win **€ 0** if one of the following balls is extracted:

7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 13



Win € **20** if one of the following balls is extracted:

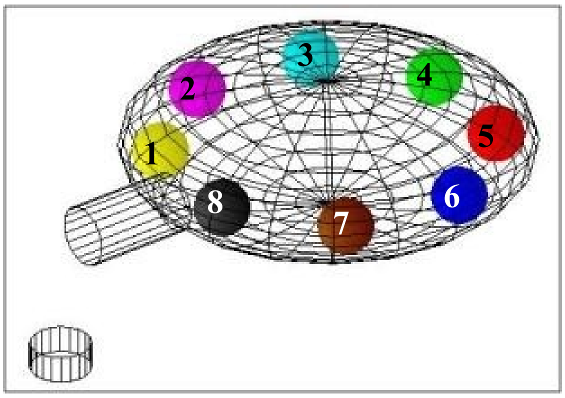
1 **2** **3** **4** **5** **6** **7**

Win € **0** if one of the following balls is extracted:

8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 14



Win **€ 20** if one of the following balls is extracted:

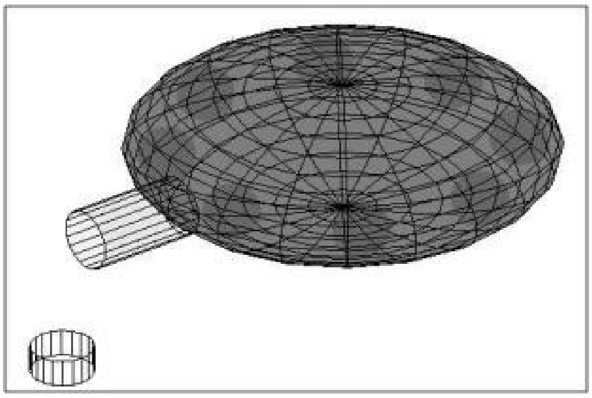
1 2 3 4 5 6 7

Win **€ 5** if one of the following balls is extracted:

8

Lottery	Sure	
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 15



Win **€ 20** if one of the following balls is extracted:

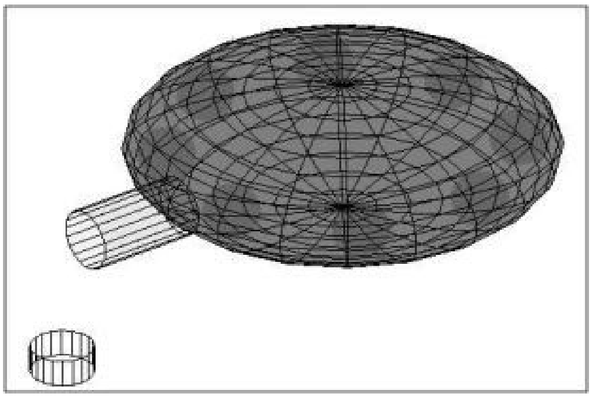
1

Win **€ 0** if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 16



Win **€ 20** if one of the following balls is extracted:

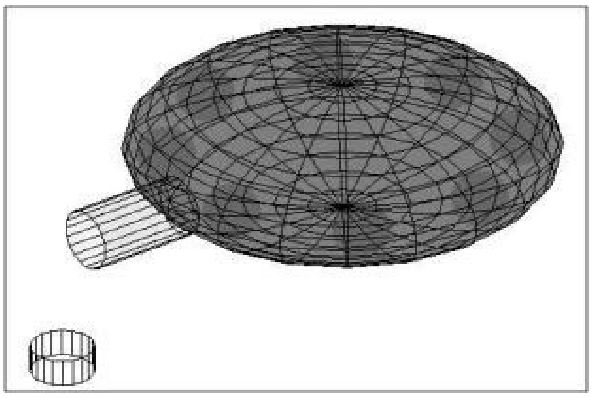
1

Win **€ 5** if one of the following balls is extracted:

2 **3** **4** **5** **6** **7** **8**

Lottery	Sure	
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure
O	O	

Decision 17



Win **€ 20** if one of the following balls is extracted:

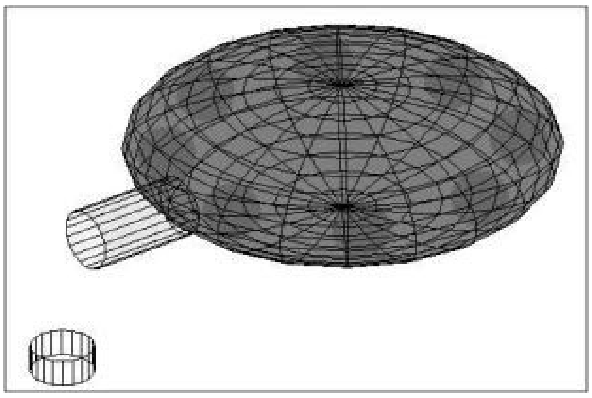
1 **2**

Win **€ 0** if one of the following balls is extracted:

3 **4** **5** **6** **7** **8**

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 18



Win **€ 20** if one of the following balls is extracted:

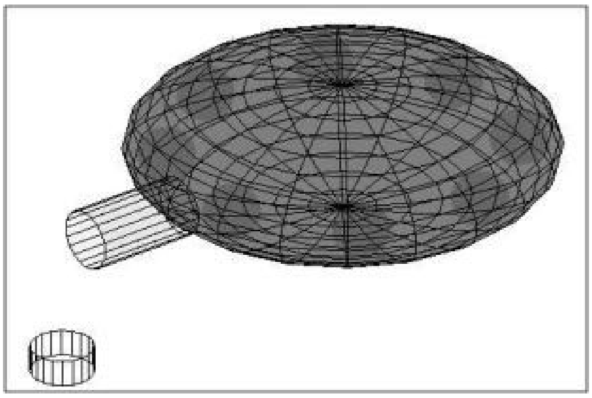
1 2 3

Win **€ 0** if one of the following balls is extracted:

4 5 6 7 8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 19



Win **€ 20** if one of the following balls is extracted:

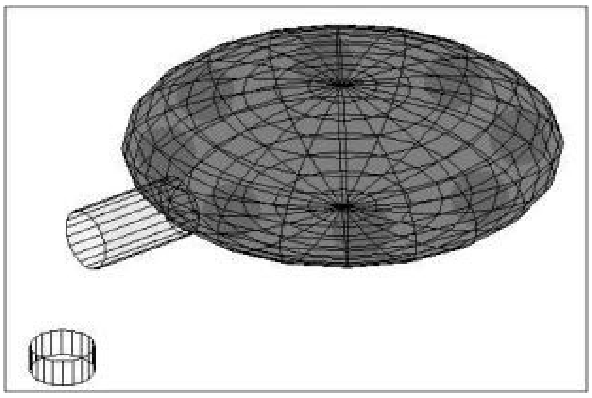
1 **2** **3** **4** **5**

Win **€ 0** if one of the following balls is extracted:

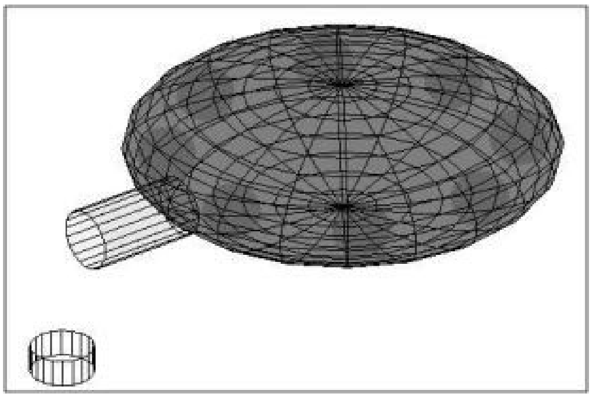
6 **7** **8**

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 20

	Lottery	Sure	
	O	O	€ 0.50 for sure
	O	O	€ 1.00 for sure
	O	O	€ 1.50 for sure
	O	O	€ 2.00 for sure
	O	O	€ 2.50 for sure
	O	O	€ 3.00 for sure
	O	O	€ 3.50 for sure
	O	O	€ 4.00 for sure
	O	O	€ 4.50 for sure
	O	O	€ 5.00 for sure
	O	O	€ 5.50 for sure
	O	O	€ 6.00 for sure
	O	O	€ 6.50 for sure
Win € **20** if one of the following balls is extracted:	O	O	€ 7.00 for sure
1 **2** **3** **4** **5** **6**	O	O	€ 7.50 for sure
	O	O	€ 8.00 for sure
Win € **0** if one of the following balls is extracted:	O	O	€ 8.50 for sure
7 **8**	O	O	€ 9.00 for sure
	O	O	€ 9.50 for sure
	O	O	€ 10.00 for sure
	O	O	€ 10.50 for sure
	O	O	€ 11.00 for sure
	O	O	€ 11.50 for sure
	O	O	€ 12.00 for sure
	O	O	€ 12.50 for sure
	O	O	€ 13.00 for sure
	O	O	€ 13.50 for sure
	O	O	€ 14.00 for sure
	O	O	€ 14.50 for sure
	O	O	€ 15.00 for sure
	O	O	€ 15.50 for sure
	O	O	€ 16.00 for sure
	O	O	€ 16.50 for sure
	O	O	€ 17.00 for sure
	O	O	€ 17.50 for sure
	O	O	€ 18.00 for sure
	O	O	€ 18.50 for sure
	O	O	€ 19.00 for sure
	O	O	€ 19.50 for sure

Decision 21



Win **€ 20** if one of the following balls is extracted:

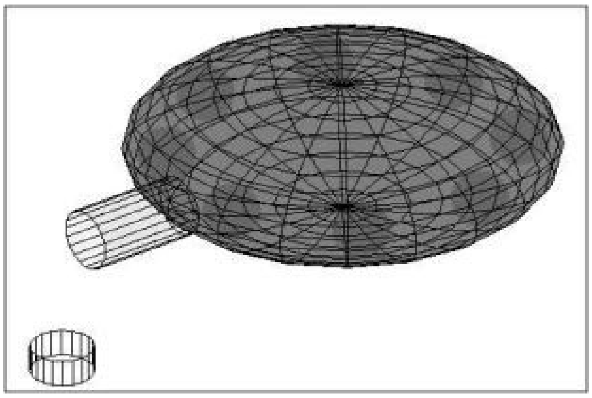
1 **2** **3** **4** **5** **6** **7**

Win **€ 0** if one of the following balls is extracted:

8

Lottery	Sure	
O	O	€ 0.50 for sure
O	O	€ 1.00 for sure
O	O	€ 1.50 for sure
O	O	€ 2.00 for sure
O	O	€ 2.50 for sure
O	O	€ 3.00 for sure
O	O	€ 3.50 for sure
O	O	€ 4.00 for sure
O	O	€ 4.50 for sure
O	O	€ 5.00 for sure
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure

Decision 22



Win € **20** if one of the following balls is extracted:

1 2 3 4 5 6 7

Win € **5** if one of the following balls is extracted:

8

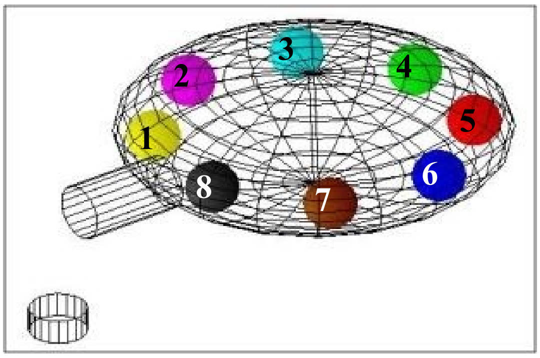
Lottery	Sure	
O	O	€ 5.50 for sure
O	O	€ 6.00 for sure
O	O	€ 6.50 for sure
O	O	€ 7.00 for sure
O	O	€ 7.50 for sure
O	O	€ 8.00 for sure
O	O	€ 8.50 for sure
O	O	€ 9.00 for sure
O	O	€ 9.50 for sure
O	O	€ 10.00 for sure
O	O	€ 10.50 for sure
O	O	€ 11.00 for sure
O	O	€ 11.50 for sure
O	O	€ 12.00 for sure
O	O	€ 12.50 for sure
O	O	€ 13.00 for sure
O	O	€ 13.50 for sure
O	O	€ 14.00 for sure
O	O	€ 14.50 for sure
O	O	€ 15.00 for sure
O	O	€ 15.50 for sure
O	O	€ 16.00 for sure
O	O	€ 16.50 for sure
O	O	€ 17.00 for sure
O	O	€ 17.50 for sure
O	O	€ 18.00 for sure
O	O	€ 18.50 for sure
O	O	€ 19.00 for sure
O	O	€ 19.50 for sure
O	O	

PART II

If part II should be chosen for real play, you are endowed with €20. These €20 are yours, but it is possible that you will lose part or all of the money in the experiment (but no more than that).

In part II you are again asked to repeatedly choose between the two types of lotteries you have already encountered in part I of the experiment and a series of sure amounts. However, the main difference now is that **the amounts involved are negative instead of positive**. Figure 4 shows an example of such a choice.

Fig. 4: example of a typical decision task from part II

	O	O	– € 0.50 for sure
	O	O	– € 1.00 for sure
	O	O	– € 1.50 for sure
	O	O	– € 2.00 for sure
	O	O	– € 2.50 for sure
	O	O	– € 3.00 for sure
	O	O	– € 3.50 for sure
	O	O	– € 4.00 for sure
	O	O	– € 4.50 for sure
Lose € 10 if one of the following balls is extracted:	O	O	– € 5.00 for sure
1 2 3 4	O	O	– € 5.50 for sure
	O	O	– € 6.00 for sure
	O	O	– € 6.50 for sure
Lose € 0 if one of the following balls is extracted:	O	O	– € 7.00 for sure
5 6 7 8	O	O	– € 7.50 for sure
	O	O	– € 8.00 for sure
	O	O	– € 8.50 for sure
	O	O	– € 9.00 for sure
	O	O	– € 9.50 for sure

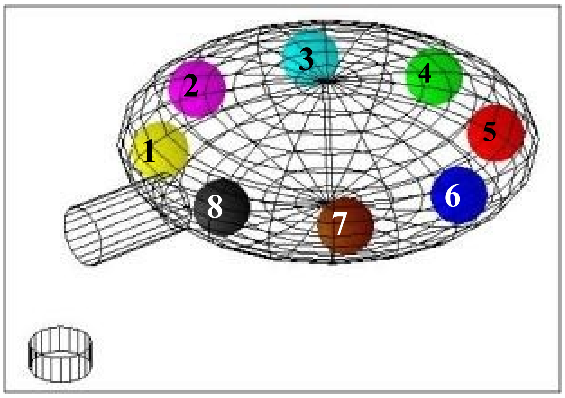
In the example displayed, you face the following lottery: if a ball with the number 1 , 2 , 3, or 4 is extracted, **you lose €10**. If a ball with the number 5 , 6 , 7 , or 8 is extracted, you lose nothing. Please choose again for each row whether you would rather give up (i.e., pay) the sure amount indicated to the right or play the lottery.

Notice that, most likely, you will now **begin to the right** by choosing to give up the sure amounts as long as this implies giving up small amounts, and then switch to the lottery at a certain point. If you do not want to give up sure amounts at all, then in the first row you can choose the lottery and then continue with the lottery for all choices (if you are not willing to pay €0.50 to avoid playing the lottery, then you should not be willing to pay €1.00 to avoid it). Once again, when exactly you switch from the sure loss to the lottery depends entirely on your preferences—there are no right or wrong answers. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example because you have not ticked any box for a given row or ticked both boxes for a row).

In addition to the pure loss choices described above, you will also face some choices in which **both**

negative **<u>and</u>** **positive amounts are involved**. Also, what changes is now not the sure amount to the right, which is always equal to zero, but rather the amount you can lose in the lottery. Figure 3 shows an example of this kind of choice problem.

Fig. 3: decision task where lottery amount changes



Win € 20 if one of the following balls is extracted:

1 2 3 4

If one of the following balls is extracted, then:

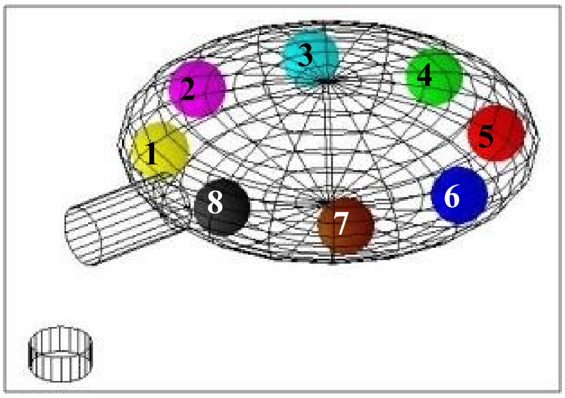
5 6 7 8

Lose € 20	O	O	€ 0 for sure
Lose € 19	O	O	€ 0 for sure
Lose € 18	O	O	€ 0 for sure
Lose € 17	O	O	€ 0 for sure
Lose € 16	O	O	€ 0 for sure
Lose € 15	O	O	€ 0 for sure
Lose € 14	O	O	€ 0 for sure
Lose € 13	O	O	€ 0 for sure
Lose € 12	O	O	€ 0 for sure
Lose € 11	O	O	€ 0 for sure
Lose € 10	O	O	€ 0 for sure

What is required of you in this task is exactly the same as for the other tasks. For each row, you should choose whether you prefer the sure amount to the right (which is now always zero), or the lottery to the left. Pay attention however: **what changes is now the amount that can be lost in the lottery**. Most likely, you would thus start from the right and choose zero for high losses, and then switch to the left as the losses in the lottery get smaller. You can however also start with the lottery and continue with it if that is your preference (if you prefer a lottery in which you can win €20 or lose €20 to zero, then you should also prefer the lottery when you can lose only €19). When you switch from the zero sure amount to the lottery depends only on your preferences—there is no right or wrong answer. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example because you have not ticked any box for a given row or ticked both boxes for a row).

Payoff determination
In case part II should be chosen for real play, your payoff from part II will be determined in a way analogous to the payoff determination in the first part. First, one of the decision tasks will be chosen at random, and then one of the rows for which you had to indicate a choice. In each case, **every choice task or row has an equal probability of being selected**. According to your choice, you are will then have to pay the sure amount, or the lottery will be played out by drawing a ball from the indicated urn.

Decision II-1



Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure

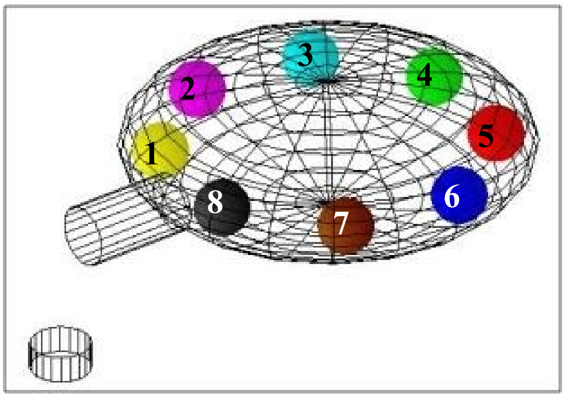
Lose € 5 if one of the following balls is extracted:

1 2 3 4

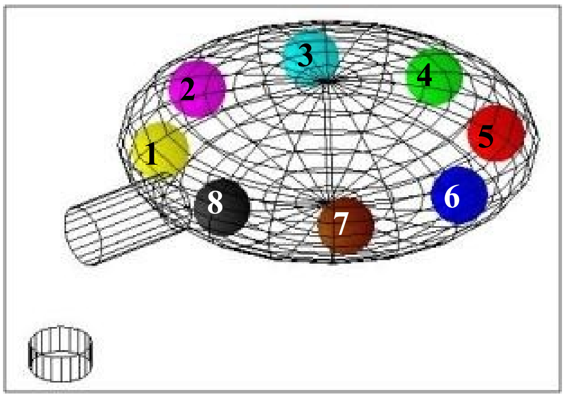
Lose € 0 if one of the following balls is extracted:

5 6 7 8

Decision II-2

	Lottery	Sure	
	O	O	– € 0.50 for sure
	O	O	– € 1.00 for sure
	O	O	– € 1.50 for sure
	O	O	– € 2.00 for sure
	O	O	– € 2.50 for sure
	O	O	– € 3.00 for sure
	O	O	– € 3.50 for sure
	O	O	– € 4.00 for sure
	O	O	– € 4.50 for sure
	O	O	– € 5.00 for sure
	O	O	– € 5.50 for sure
	O	O	– € 6.00 for sure
	O	O	– € 6.50 for sure
Lose € 10 if one of the following balls is extracted:	O	O	– € 7.00 for sure
1 2 3 4	O	O	– € 7.50 for sure
	O	O	– € 8.00 for sure
Lose € 0 if one of the following balls is extracted:	O	O	– € 8.50 for sure
5 6 7 8	O	O	– € 9.00 for sure
	O	O	– € 9.50 for sure

Decision II-3



Lose € 20 if one of the following balls is extracted:

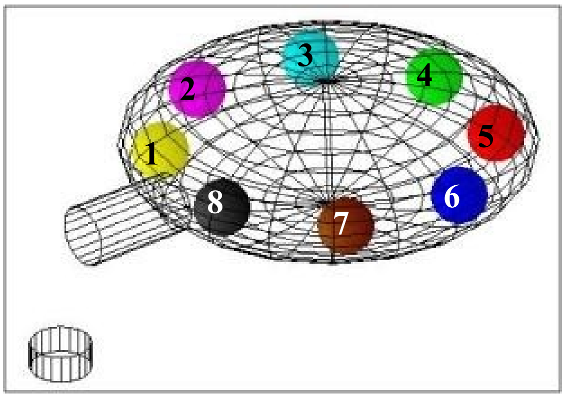
1 2 3 4

Lose € 0 if one of the following balls is extracted:

5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-4



Lose € 20 if one of the following balls is extracted:

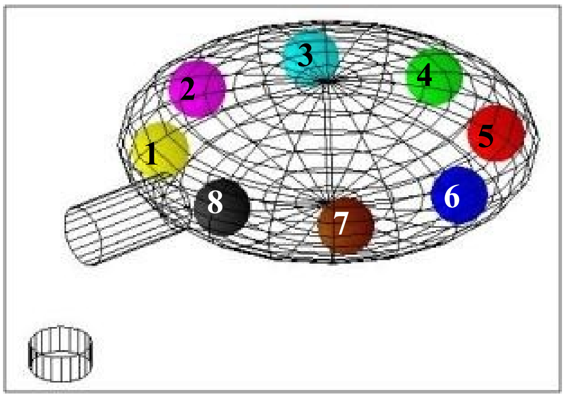
1 2 3 4

Lose € 5 if one of the following balls is extracted:

5 6 7 8

Lottery	Sure	
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-5



Lose € 20 if one of the following balls is extracted:

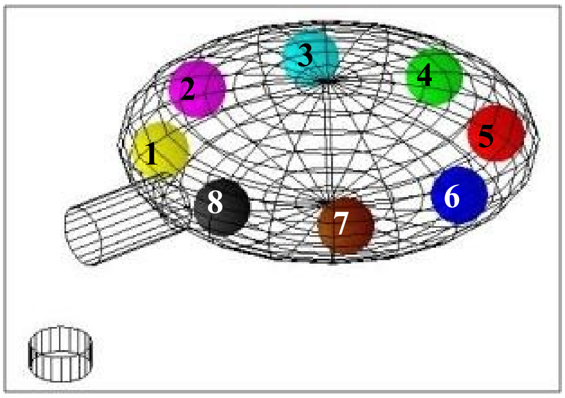
1 2 3 4

Lose € 10 if one of the following balls is extracted:

5 6 7 8

Lottery	Sure	
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-6



Lose € 20 if one of the following balls is extracted:

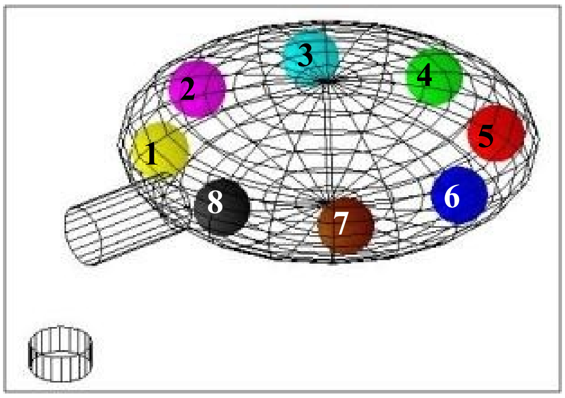
1

Lose € 0 if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-7



Lose € 20 if one of the following balls is extracted:

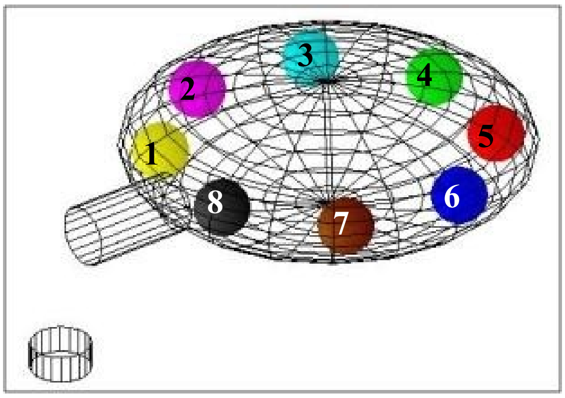
1

Lose € 5 if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-8



Lose € 20 if one of the following balls is extracted:

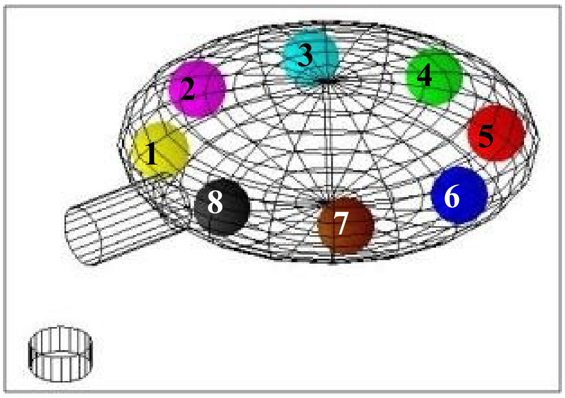
1 2

Lose € 0 if one of the following balls is extracted:

3 4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-9



Lose € 20 if one of the following balls is extracted:

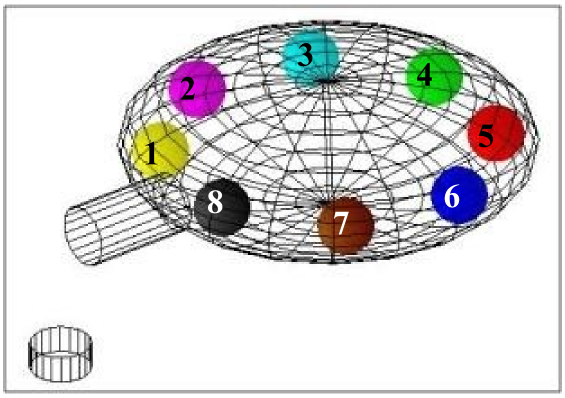
1 2 3

Lose € 0 if one of the following balls is extracted:

4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-10



Lose € 20 if one of the following balls is extracted:

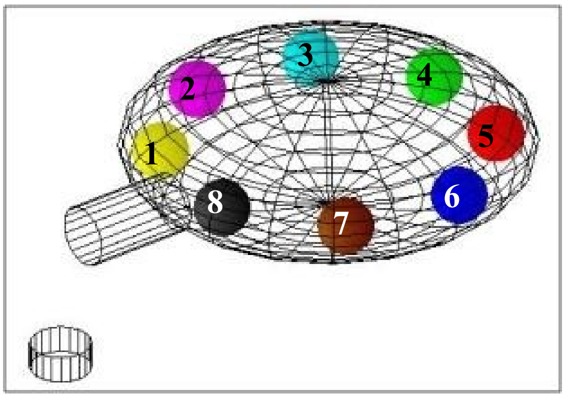
1 2 3 4 5

Lose € 0 if one of the following balls is extracted:

6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-11



Lose € 20 if one of the following balls is extracted:

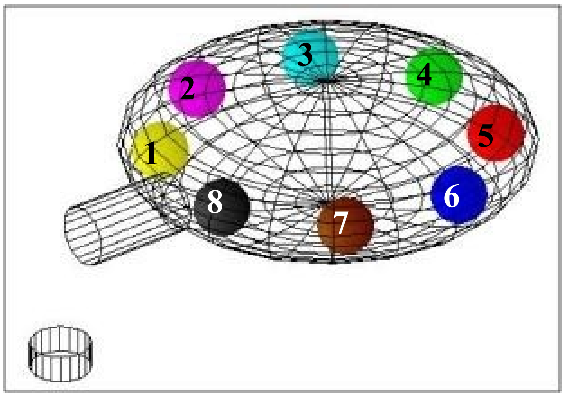
1 2 3 4 5 6

Lose € 0 if one of the following balls is extracted:

7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-12



Lose € 20 if one of the following balls is extracted:

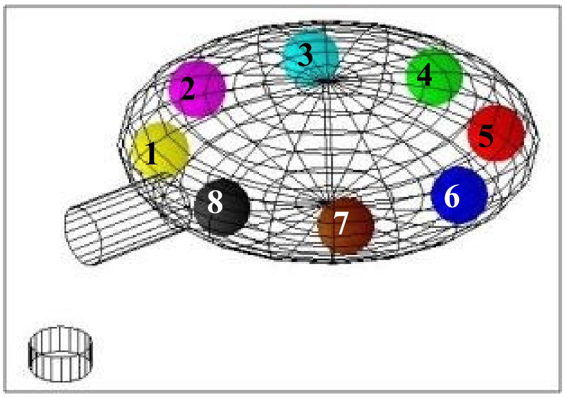
1 2 3 4 5 6 7

Lose € 0 if one of the following balls is extracted:

8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-13



Lose € 20 if one of the following balls is extracted:

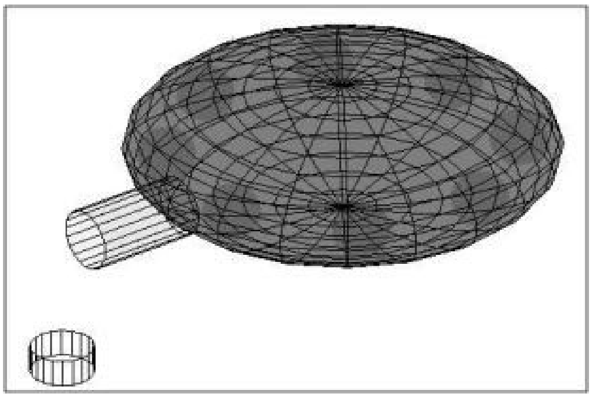
1 2 3 4 5 6 7

Lose € 5 if one of the following balls is extracted:

8

Lottery	Sure	
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-14



Lose € 20 if one of the following balls is extracted:

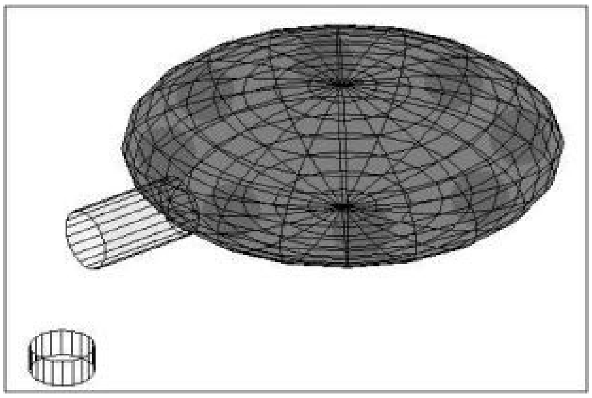
1

Lose € 0 if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-15



Lose € 20 if one of the following balls is extracted:

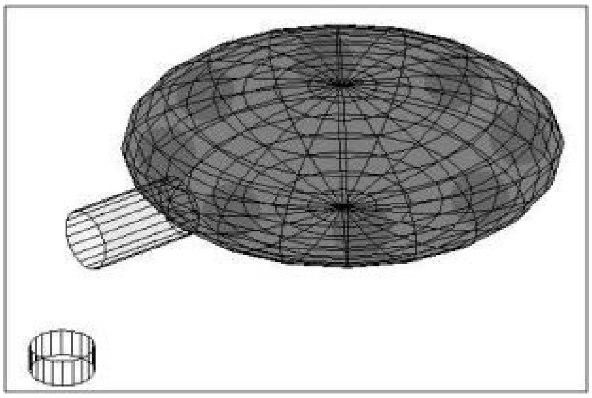
1

Lose € 5 if one of the following balls is extracted:

2 3 4 5 6 7 8

Lottery	Sure	
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-16



Lose € 20 if one of the following balls is extracted:

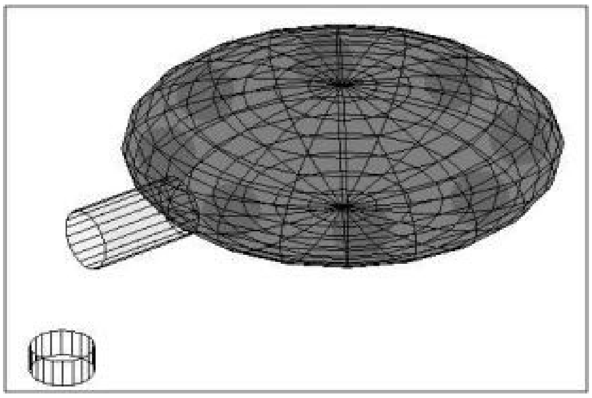
1 2

Lose € 0 if one of the following balls is extracted:

3 4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-17



Lose € 20 if one of the following balls is extracted:

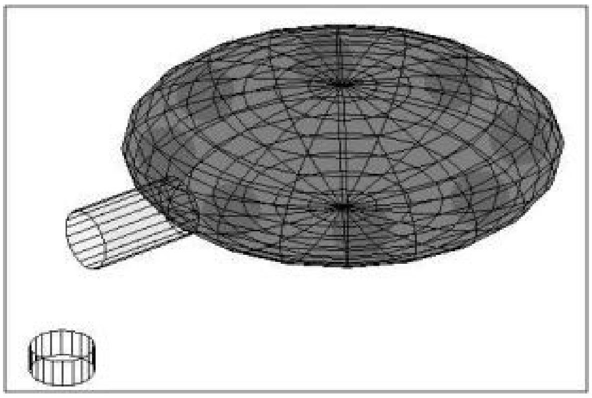
1 2 3

Lose € 0 if one of the following balls is extracted:

4 5 6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-18



Lose € 20 if one of the following balls is extracted:

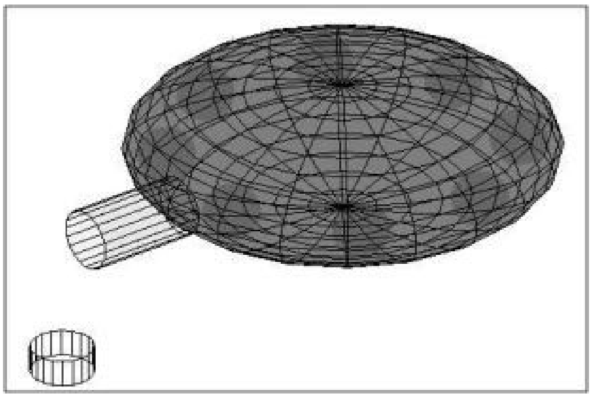
1 2 3 4 5

Lose € 0 if one of the following balls is extracted:

6 7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-19



Lose € 20 if one of the following balls is extracted:

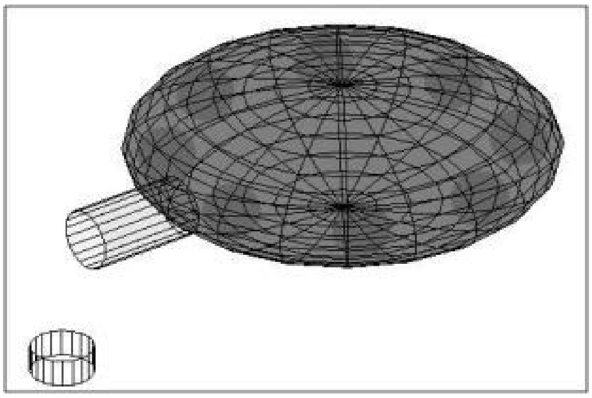
1 2 3 4 5 6

Lose € 0 if one of the following balls is extracted:

7 8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-20



Lose € 20 if one of the following balls is extracted:

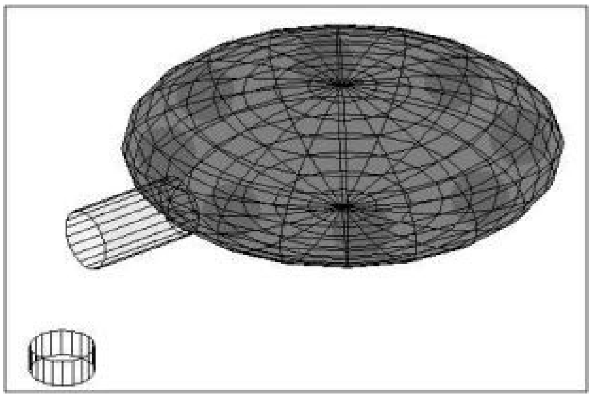
1 2 3 4 5 6 7

Lose € 0 if one of the following balls is extracted:

8

Lottery	Sure	
O	O	– € 0.50 for sure
O	O	– € 1.00 for sure
O	O	– € 1.50 for sure
O	O	– € 2.00 for sure
O	O	– € 2.50 for sure
O	O	– € 3.00 for sure
O	O	– € 3.50 for sure
O	O	– € 4.00 for sure
O	O	– € 4.50 for sure
O	O	– € 5.00 for sure
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-21



Lose € 20 if one of the following balls is extracted:

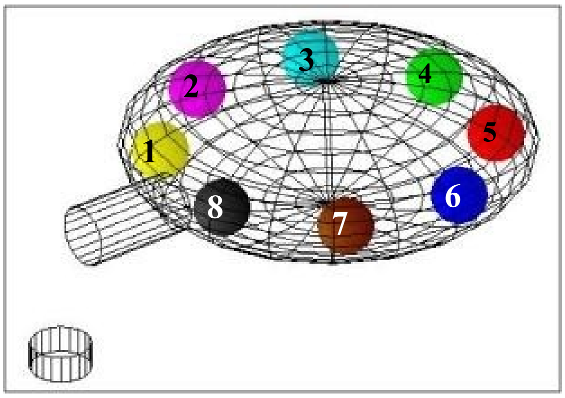
1 2 3 4 5 6 7

Lose € 5 if one of the following balls is extracted:

8

Lottery	Sure	
O	O	– € 5.50 for sure
O	O	– € 6.00 for sure
O	O	– € 6.50 for sure
O	O	– € 7.00 for sure
O	O	– € 7.50 for sure
O	O	– € 8.00 for sure
O	O	– € 8.50 for sure
O	O	– € 9.00 for sure
O	O	– € 9.50 for sure
O	O	– € 10.00 for sure
O	O	– € 10.50 for sure
O	O	– € 11.00 for sure
O	O	– € 11.50 for sure
O	O	– € 12.00 for sure
O	O	– € 12.50 for sure
O	O	– € 13.00 for sure
O	O	– € 13.50 for sure
O	O	– € 14.00 for sure
O	O	– € 14.50 for sure
O	O	– € 15.00 for sure
O	O	– € 15.50 for sure
O	O	– € 16.00 for sure
O	O	– € 16.50 for sure
O	O	– € 17.00 for sure
O	O	– € 17.50 for sure
O	O	– € 18.00 for sure
O	O	– € 18.50 for sure
O	O	– € 19.00 for sure
O	O	– € 19.50 for sure

Decision II-22



Win € 20 if one of the following balls is extracted:

1 2 3 4

If one of the following balls is extracted, then:

5 6 7 8

	Lottery	Sure	
Lose € 20	O	O	€ 0 for sure
Lose € 19	O	O	€ 0 for sure
Lose € 18	O	O	€ 0 for sure
Lose € 17	O	O	€ 0 for sure
Lose € 16	O	O	€ 0 for sure
Lose € 15	O	O	€ 0 for sure
Lose € 14	O	O	€ 0 for sure
Lose € 13	O	O	€ 0 for sure
Lose € 12	O	O	€ 0 for sure
Lose € 11	O	O	€ 0 for sure
Lose € 10	O	O	€ 0 for sure
Lose € 9	O	O	€ 0 for sure
Lose € 8	O	O	€ 0 for sure
Lose € 7	O	O	€ 0 for sure
Lose € 6	O	O	€ 0 for sure
Lose € 5	O	O	€ 0 for sure
Lose € 4	O	O	€ 0 for sure
Lose € 3	O	O	€ 0 for sure

Questionnaire

Please answer the following questions about yourself. All answers are confidential and cannot be traced back to you personally.

Age: ___________ Study semester:____________

O female O male

What is your studies major?
O economics or business
O mathematics or engineering
O natural sciences
O medicine
O social sciences
O humanities
O arts
O other

Please indicate your grade point average: __________

Are you originally from $$name of country where exp. is to take place$$? O yes O no

If not, which country are you from originally? __________________

Are both your parents from $$name of country where exp. is to take place$$? O yes O no

Have you ever lived abroad for a significant period of time?
O never
O less than six months
O between six months and a year
O between one and two years
O between two and five years
O longer than five years

Could you give a rough indication of your monthly living expenses? _________
Could you give a rough indication of your monthly stipend? ___________

Please indicate how many older siblings you have:_____________
Please indicate how many younger siblings you have:______________

Are you married? O yes O no

How tall are you? ___________cm

Please consider the following statement: “Man-induced climate change is a serious danger that could threaten our way of life”. Please indicate on the scale below the extent to which you agree with this statement, with 1 indicating “I don't agree at all” and 7 indicating “I fully agree”:

1	2	3	4	5	6	7
O	O	O	O	O	O	O

Please consider the following statement: “It is imperative to take immediate action to limit potential catastrophic consequences from changes in global climate, even if such action may be costly”. Please indicate on the scale below the extent to which you agree with this statement, with 1 indicating “I don't agree at all” and 7 indicating “I fully agree”:

1	2	3	4	5	6	7
O	O	O	O	O	O	O

The following section seeks to evaluate your cultural orientation. Please indicate your agreement with each of the following statements:

	Stongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Individuals should sacrifice self-interest for the group that they belong to	O	O	O	O	O
2. Individuals should stick with the group even through difficulties	O	O	O	O	O
3. Group welfare is more important than individual rewards	O	O	O	O	O
4. Group success is more important than individual success	O	O	O	O	O
5. Individuals should pursue their goals after considering the welfare of the group	O	O	O	O	O
6. Group loyalty should be encouraged even if individual goals suffer	O	O	O	O	O
7. People in higher positions should make most decisions without consulting people in lower positions	O	O	O	O	O
8. People in higher positions should not delegate important tasks to people in lower positions	O	O	O	O	O
9. People in higher positions should not ask the opinions of people in lower positions too frequently	O	O	O	O	O
10. People ion higher positions should avoid social interaction with people in lower positions	O	O	O	O	O
11. People in lower positions should not disagree with decisions made by people in higher positions	O	O	O	O	O
12. It is important to have instructions spelled out in detail so that I always know what I am expected to do	O	O	O	O	O
13. It is important to closely follow instructions and procedures	O	O	O	O	O
14. Rules/regulations are important because they inform me of what is expected of me	O	O	O	O	O
15. Standardized work procedures are helpful	O	O	O	O	O
16. Instructions for operations are important	O	O	O	O	O
17. It is more important for men to have a professional career than it is for women	O	O	O	O	O
18. Men usually solve problems with logical analysis; women usually solve problems with intuition	O	O	O	O	O
19. Solving difficult problems usually requires an active forcible approach, which is typical for men	O	O	O	O	O
20. There are some jobs that a man can always do better than a woman	O	O	O	O	O
21. Even though certain food products are available in a number of different flavors, I tend to buy the same flavor	O	O	O	O	O
22. I would rather stick with a brand I usually buy than try something I am not very sure of	O	O	O	O	O
23. I think of myself as a brand-loyal consumer	O	O	O	O	O
24. When I go to a restaurant, I feel it is safer to order dishes I am familiar with	O	O	O	O	O
25. If I like a brand, I rarely switch from it just to try something different	O	O	O	O	O
26. I am very cautious in trying new or different products	O	O	O	O	O
27. I rarely buy brands about which I am uncertain how they will perform	O	O	O	O	O
28. I usually eat the same kinds of foods on a regular basis	O	O	O	O	O

How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks? Please tick a box on the scale below, where 0 means “risk averse” and 10 means “fully prepared to take risks”:

Risk averse										Fully prepared to take risks
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
O	O	O	O	O	O	O	O	O	O	O

People can behave differently in different situations.
How would you rate your willingness to take risks in the following areas?
How is it … fully prepared
risk averse to take risks

	0	1	2	3	4	5	6	7	8	9	10
– while driving?	O	O	O	O	O	O	O	O	O	O	O
– in financial matters?	O	O	O	O	O	O	O	O	O	O	O
– during leisure and sport?	O	O	O	O	O	O	O	O	O	O	O
– in your occupation?	O	O	O	O	O	O	O	O	O	O	O
– with your health?	O	O	O	O	O	O	O	O	O	O	O
– your faith in other people?	O	O	O	O	O	O	O	O	O	O	O

Please consider what you would do in the following situation:

Imagine that you had won 100,000 Euros in the lottery. Almost immediately after you collect the winnings, you receive the following financial offer from a reputable bank, the conditions of which are as follows:
There is the chance to double the money within two years. It is equally possible that you could lose half of the amount invested. You have the opportunity to invest the full amount, part of the amount or reject the offer. What share of your lottery winnings would you be prepared to invest in this financially risky, yet lucrative investment?

O 100.000 Euros
O 80.000 Euros
O 60.000 Euros
O 40.000 Euros
O 20.000 Euros
O Nothing, I would decline the offer

How many inhabitants has the town where you lived at the age of 16?

____________________inhabitants

What are your religious views?
O atheist/agnostic
O catholic
O protestant
O muslim
O jewish
O hinduist
O buddist
O other: ________________

Thank you for taking part in this experiment! Please remain seated until an experimenter calls you up.

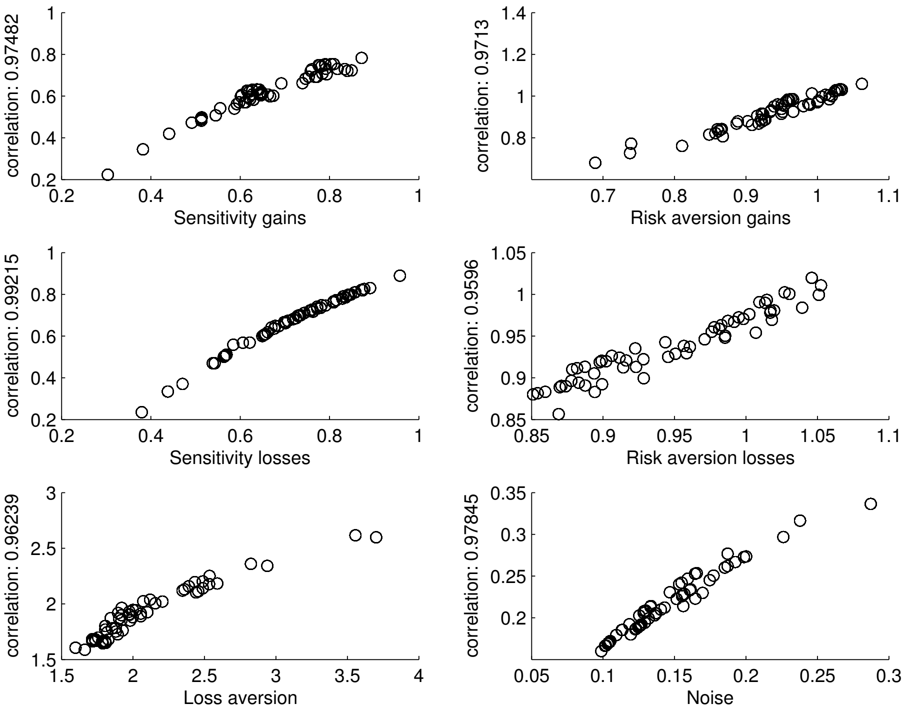


Figure A.5: Correlation between pooled estimates and random effects: macro indicators