Technical Appendix

The Risk Attitudes of Professional Athletes: Optimism and Success are Related

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A1. Test of the difference between the professional and the recreational samples

In the follow-up survey we measured cognitive abilities (using Frederick's (2005) CRT test), the confidence participants had in their responses to the CRT test, and venturesomeness and impulsiveness using the Dutch translation of the I_7. We also obtained information on education and stock holdings. 28 out of 31 professionals and all recreational players returned the questionnaire. Table A-1 (Table 3 in the main text) shows the descriptive statistics for these variables.

Table A-1 : Descriptive statistics

Variable	ALL	PROFESSIONALS N=28	RECREATIONALS N=31
Mean age	24.12	24.46	23.81
Education			
College	93%	89%	96%
Other	7%	11%	4%
Holding Stocks	29%	21%	35%
Mean CRT Score	2.36	2.21	2.48
Mean confidence in CRT	0.94	0.91	0.96
Impulsiveness	7.83	7.79	7.87
Venturesomeness	9.58	9.39	9.74

To compare the multivariate distribution of the variables described in Table A-1, we performed a minimum distance non-bipartite matching. We created 29 optimally matched pairs of participants based on the Mahalanobis distance between the ranks of each of the 7 covariates (Rosenbaum, 2005). For the 59 respondents to the questionnaire, participants were first optimally matched in 30 pairs (including a pseudosubject). Removing the pair with the pseudosubject, we ended up with 29 pairs of participants. Among these pairs, 5 pairs consisted of two professionals, 5 pairs consisted of two recreational players and 18 pairs consisted of one professional and one recreational player. The p-value of Rosenbaum's exact test associated with this optimal non-bipartite matching was equal to 0.96. The null hypothesis that the professional and the recreational players had identical multivariate distributions of the variables in Table A-1 could therefore not be rejected.

B. Covariates and experimental measures of utility

To asses the role of age, cognitive abilities, confidence, financial situation and personality traits on utility curvature, we regressed the areas under the individual utility functions on the covariates described in Table A-1. We took into account the correlated nature of errors between gains and losses by using seemingly unrelated regression (SUR). Table B-1 shows the results of the estimation. No covariate had a significant effect on utility curvature.

Table B-1 : SUR Estimation on Utility curvature (full set of covariates)

	Gains	**Losses**
Professional (0/1)	0.060	0.039
	(1.63)	(1.04)
Age	−0.011	0.001
	(1.42)	(0.19)
Lower education	0.021	0.041
	(0.31)	(0.59)
Stocks (0/1)	−0.038	-0.051
	(0.94)	(1.27)
CRT (0/1/2/3)	0.032	−0.014
	(1.16)	(0.50)
Confidence (0-100%)	0.146	0.301
	(0.54)	(1.10)
Impulsiveness (0-19)	0.005	0.002
	(0.87)	(0.25)
Venturesomeness (0-16)	0.004	0.013
	(0.40)	(1.38)
Constant	0.507	0.121
	(1.60)	(0.38)
Observations	58	58

Notes : Absolute value of z-statistics in parentheses : * significant at 5% level; ** significant at 1% level

We also performed a SUR estimation with the set of covariates restricted to the professional/recreational status and the CRT score. Table B-2 shows the results of this estimation. The CRT score still had no significant effect on the utility curvature for gains and losses.

Table B-2 : SUR Estimation on Utility curvature (restricted set of covariates)

	Gains	Losses
Professional (0/1)	0.052	0.032
	(1.46)	(0.90)
CRT (0/1/2/3)	0.040	0.005
	(1.87)	(0.23)
Constant	0.425**	0.518**
	(7.23)	(8.71)
Observations	58	58

Absolute value of z-statistics in parentheses, * significant at 5% level; ** significant at 1% level

The personality measures (impulsiveness and venturesomeness) were unrelated with utility curvature for both gains and losses. Between impulsivity and utility curvature, Kendall's tau was 0.04 for gains and 0.02 losses (both $p > 0.10$). Between venturesomeness and utility curvature Kendall's tau was 0.08 for gains and 0.14 for losses (both $p > 0.10$). Figure B-1 shows this absence of correlation.

Figure B-1 : Utility curvature for gains and losses and personality measures.

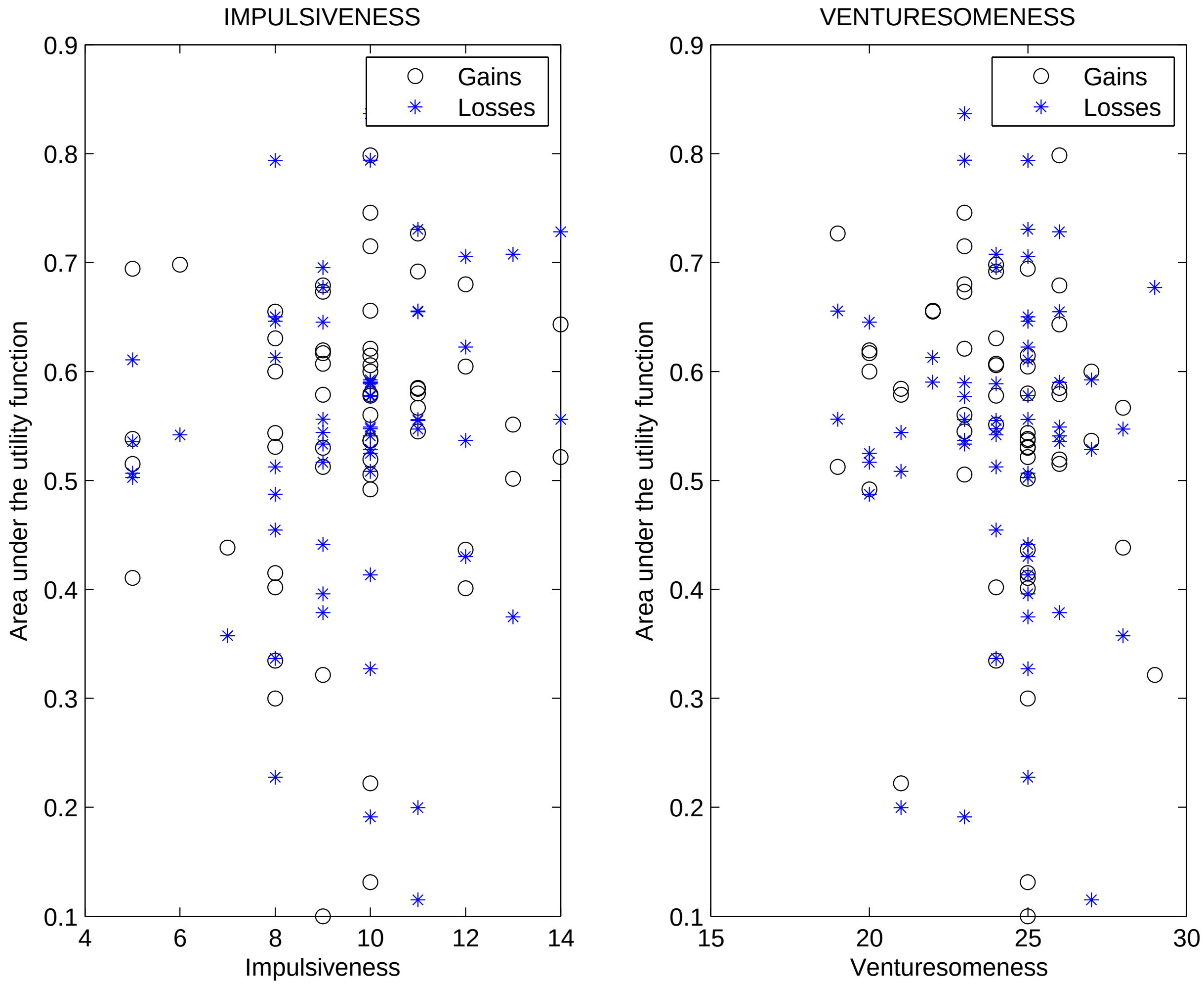


Table B-3 shows the results from this estimation for the loss aversion coefficient. No covariate had a significant effect on loss aversion.

Table B-3 : Linear regression on loss aversion (full set of covariates)

	Gains
Professional (0/1)	−0.715
	(0.74)
Age	0.167
	(0.81)
Lower education	−0.558
	(0.31)
Stocks (0/1)	−0.302
	(0.28)
CRT (0/1/2/3)	0.599
	(0.81)
Confidence (0-100%)	−8.853
	(1.23)
Impulsiveness (0-19)	−0.123
	(0.77)
Venturesomeness (0-16)	0.076
	(0.31)
Constant	6.336
	(0.77)
Observations	59

Notes : Absolute value of z-statistics in parentheses : * significant at 5% level; ** significant at 1% level

C. Covariates and experimental measures of optimism and sensivitiy

To asses the role of age, cognitive abilities, confidence, financial situation and personality traits on optimism as measured in the experiment, we regressed the parameters δ^+ and δ^- on the covariates described in Table A-1. Again, to account for the correlated nature of errors between gains and losses we used seemingly unrelated regression (SUR). Table C-1 (Table 4 in the main text) shows the results of the estimation. The professional players were significantly more optimistic than the recreational players for gains even after controlling for all the other variables. For losses, optimism was associated with less stock holdings and higher venturesomeness.

Table C-1 : SUR Estimation on the measures of optimism δ^{+} and δ^{-} (full set of covariates)

	Gains	Losses
Professional (0/1)	−0.432*	−0.041
	(2.43)	(0.25)
Age	0.008	0.020
	(0.23)	(0.61)
Lower education	−0.176	−0.297
	(0.54)	(1.02)
Stocks (0/1)	−0.001	0.443*
	(0.01)	(2.53)
CRT (0/1/2/3)	−0.137	0.080
	(1.03)	(0.66)
Confidence (0-100%)	0.356	−0.809
	(0.26)	(0.67)
Impulsiveness (0-19)	−0.043	0.018
	(1.45)	(0.67)
Venturesomeness (0-16)	0.007	−0.125**
	(0.15)	(3.21)
Constant	1.327	2.173
	(0.88)	(1.59)
Observations	57	57

Absolute value of z-statistics in parentheses, * significant at 5% level; ** significant at 1% level. Higher values of δ^{+}indicate less optimism, higher values of δ^{-} indicate more optimism.

We also performed a SUR estimation with the set of covariates restricted to the professional/recreational status, the I_7 personality measures and overconfidence in the CRT task. Overconfidence in the CRT task was defined as the difference between the average assessed degree of confidence in the CRT answers and the average success rate. Table C-2 shows the results from this estimation. The restricted estimation replicates the results showed in Table C-1. In particular, overconfidence was not associated with optimism.

Table C-2 : SUR Estimation on the measures of optimism δ^{+} and δ^{-} (restricted set of covariates)

	Gains	Losses
Professional (0/1)	−0.436**	−0.058
	(2.71)	(0.37)
Overconfidence (0-100%)	0.430	−0.309
	(1.19)	(0.88)
Impulsiveness (0-19)	−0.044	−0.004
	(1.57)	(0.13)
Venturesomeness (0-16)	0.010	−0.111**
	(0.23)	(2.67)
Constant	1.443**	2.284**
	(3.16)	(5.15)
Observations	57	57

Absolute value of z-statistics in parentheses, * significant at 5% level; ** significant at 1% level. Higher values of δ^{+}indicate less optimism, higher values of δ^{-} indicate more optimism.

Bivariate measures of association, show a marginally significant correlation between optimism for gains and impulsivity for the professional players (Kendall's tau: $-0.27, p = 0.06$). The observed bivariate association between optimism for losses and venturesomeness was due to the recreational group (Kendall's tau : $0.28, p = 0.05$).

We also performed an estimation for the sensitivity coefficient. Table C-3 shows the results of the estimation. For losses, oversensitivity was associated with lower education. Otherwise, no variables were significant.

Table C-3 : SUR Estimation on sensitivity (full set of covariates)

	Gains	**Losses**
Professional (0/1)	−0.042	−0.325
	(0.34)	(1.51)
Age	−0.025	0.002
	(0.96)	(0.05)
Lower education	−0.251	0.988*
	(1.13)	(2.52)
Stocks (0/1)	−0.166	−0.214
	(1.24)	(0.91)
CRT (0/1/2/3)	−0.030	0.307
	(0.32)	(1.89)
Confidence (0-100%)	−0.156	−2.524
	(0.17)	(1.55)
Impulsiveness (0-19)	−0.009	−0.062
	(0.43)	(1.74)
Venturesomeness (0-16)	−0.022	0.017
	(0.73)	(0.32)
Constant	1.690	2.705
	(1.62)	(1.48)
Observations	57	57

Absolute value of z-statistics in parentheses, * significant at 5% level; ** significant at 1% level

D. Robustness to parametric specifications for utility and probability weighting

D.1 Parametric specifications for utility

In addition to the nonparametric analysis reported in the paper, we also analyzed the results under various parametric specifications. We fitted utility with the power (CRRA), exponential (CARA), and expo-power utility. Table D-1 shows that the parametric results confirmed the conclusions drawn from the nonparametric analysis. The medians of the estimated individual coefficients were consistent with S-shaped utility. The interquartile ranges showed considerable overlap and we could not reject the null that the medians were the same for the professional and the recreational group. The parametric classification of participants showed that S-shaped utility was the dominant pattern. It was nearly identical to the nonparametric classification displayed in Table 2 of the paper .

Table D-1: Summary of individual parametric fittings of utility

The table depicts the results of fitting power, exponential, and expo-power functions on each subject's choices individually. The table shows the median and interquartile ranges (IQR) of the resulting estimates. Like in the main text, all estimates were based on the normalized ranges of outcomes and utility on the unit interval.

		Professional group		Recreational group	
		Gains	Losses	Gains	Losses
Power family	Median	0.69	0.83	0.82	0.84
	IQR	[.52-.86]	[.64-1.17]	[.63-1.05]	[.58-.99]
#S-shaped utility		19		18	
Mann-Whitney test (p-value)		0.20	0.98		
Exponential family	Median	1.22	0.52	0.56	0.54
	IQR	[.33-2.11]	[-.53-1.41]	[-.22-1.47]	[.05-1.96]
# S-shaped utility		19		18	
Mann-Whitney test (p-value)		0.21	0.94		
Expo-power family	Median	0.95	1.11	1.07	1.11
	IQR	[.76-1.16]	[.89-1.46]	[.89-1.33]	[.83-1.27]
# S-shaped utility		19		18	
Mann-Whitney test (p-value)		0.28	0.94		

For the exponential familiy, we estimated the function both on the normalized gains and losses between 0 and 1 (shown in Table D-1) and on absolute amounts (shown in Table D-2). The results were similar.

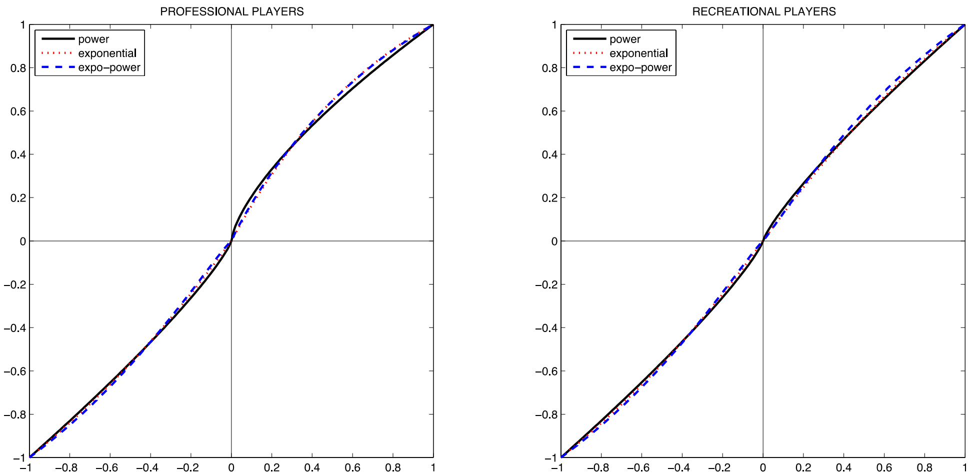
Table D-2: Summary of individual parametric fittings of utility, exponential familiy

The table depicts the results of fitting exponential functions on each subject's choices individually. Shown are the median and interquartile range (IQR) for the resulting estimates. All estimates were based on the absolute outcomes. Values are scaled by a factor 1e5.

		Professional group		Recreational group	
		Gains	Losses	Gains	Losses
Exponential family	Median	3.28	3.76	3.04	7.36
	IQR	[1.00-5.25]	[-3.45-9.42]	[-1.14-6.24]	[7.97-13.18]
# S-shaped utility		19		18	
Mann-Whitney test (p-value)		0.90	0.35		

Figure D-1 shows the fitted utility functions based on the median parameter values for the 3 parametric families (power, exponential, and expo-power) for both professional and recreational players. The figure shows that the obtained functions were very close and almost indistinguishable.

Figure D-1 : The utility for money based on median individual parameters for the power, exponential and expo-power families



Figures D-2 and D-3 show the cumulative distributions of the individual power (CRRA) coefficients for gains and losses. The figure for gains suggests slightly more concave utility for the professionals, but we cannot reject the null that the distributions were the same (Kolmogorov-Smirnov test, $p = 0.41$). For losses the distributions were very similar (Kolmogorov-Smirnov test, $p = 1.00$).

Figure D-2: Cumulative distribution of the individual power (CRRA) utility coefficients for gains

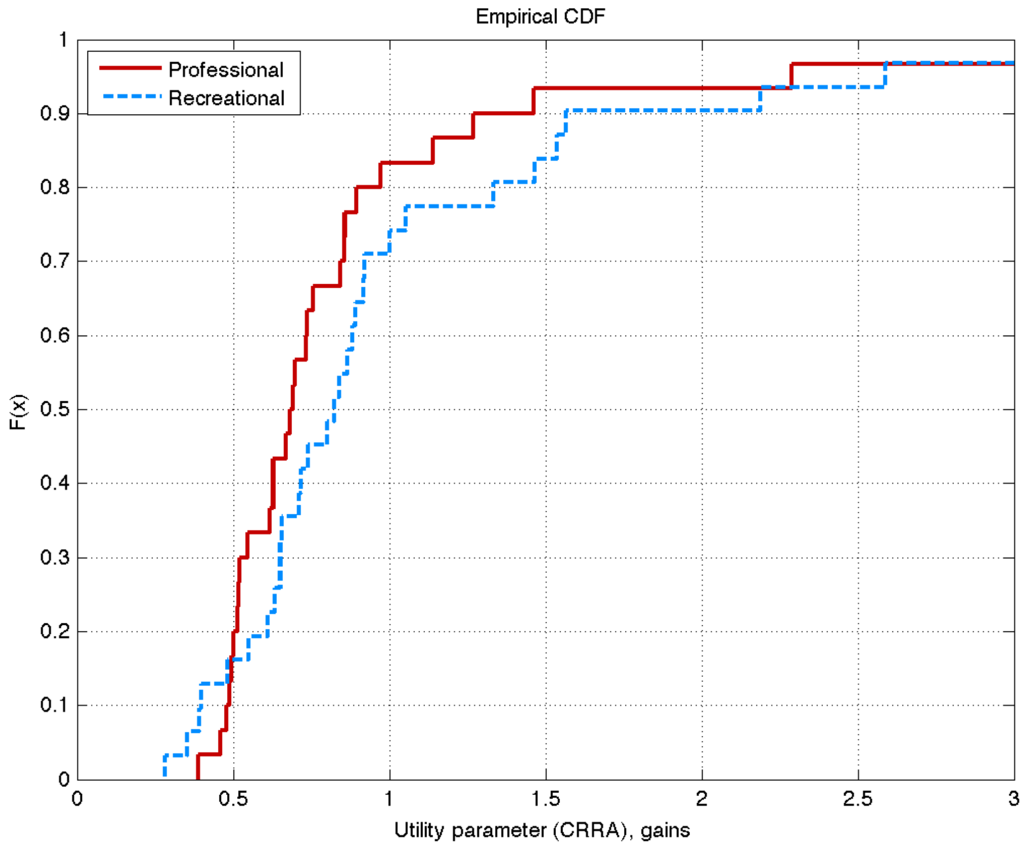
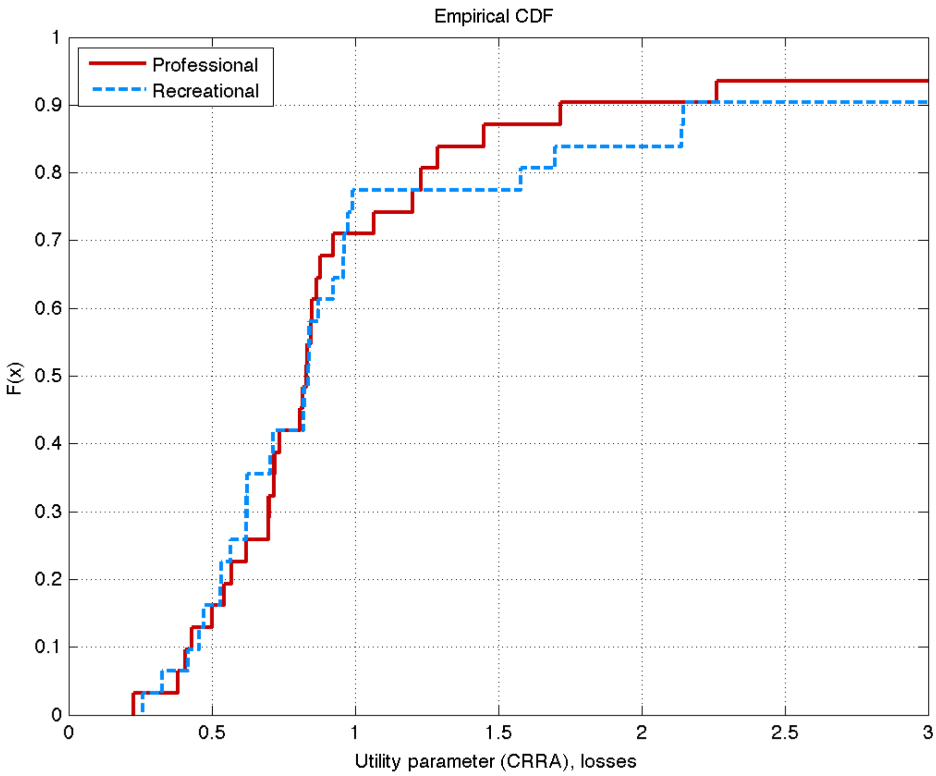


Figure D-3: Cumulative distribution of the individual power (CRRA) utility coefficients for losses



D.2 Mixed-effect regression

We also estimated a nonlinear mixed-effects regression model for each subject. Based on the individual estimated random effects, the median power (CRRA) utility coefficients for gains were 0.79 for the professionals and 0.71 for the recreational players. The difference was not significant (Mann-Whitney test, $p = 0.22$). For losses, the median individual coefficients were 0.85 for the professionals and 0.84 for the recreational players (Mann-Whitney test, $p = 0.89$).

D-3 Alternative parametric specifications for the probability weighting functions

In addition to the Prelec two-parameter weighting function, we also fitted the Goldstein-Einhorn 2-parameter specification :

$$w(p) = \frac{\delta p^{\gamma}}{\delta p^{\gamma} + (1-p)^{\gamma}}$$

We first estimated the parameters δ and γ based on the median data. For gains, δ^{+} was 1.32 for the professionals and 0.63 for the recreational players, showing, once again, much more optimism for the professionals.[1] The γ^{+} −parameters, reflecting sensitivity to changes in

[1] In the Goldstein Einhorn function higher [lower] values of δ indicate more optimism for gains [losses].

probability, were closer, 0.39 for the professionals and 0.61 for the recreational players. For losses, there was less difference in optimism ($\delta^{-} = 0.71$ for the professionals and $\delta^{-} = 1.04$ for the recreational group), but the recreational group was more sensitive to changes in probability ($\gamma^{-} = 0.48$ for the professionals and $\gamma^{-} = 0.80$ for the recreational group).

Figure D-4 : Probability weighting function for the Prelec and Goldstein Einhorn families based on the medians of the individual parameters

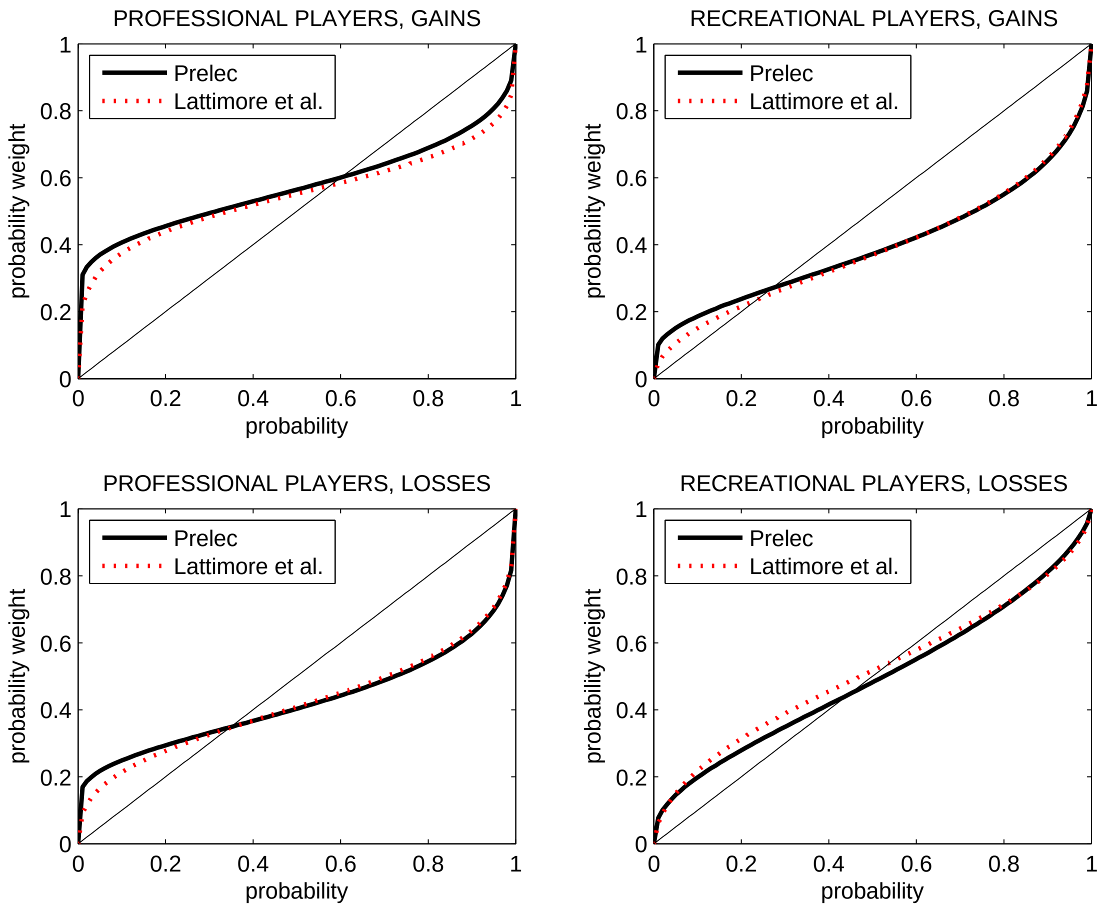


Figure D-4 shows that the Prelec and Goldstein Einhorn probability weighting functions based on the medians of the individual estimates were close. Table D-5 shows these medians. Statistical tests confirmed that optimism for gains was higher in the professional group (one tail Mann-Whitney test, $p = 0.02$). The sensitivity to changes in the probability of losses was marginally higher in the recreational group (one tail Mann-Whitney test, $p = 0.07$).

Table D-5: Median probability weighting function parameters.

The table shows the median estimated parameters of the Goldstein Einhorn probability weighting function for gains and for losses and their interquartile ranges, for both groups.

	Professional Group		Recreational Group	
Parameter	Gains	Losses	Gains	Losses
δ	1.23 [0.63-2.37]	0.69 [0.36-1.18]	0.58 [0.35-1.42]	1.07 [0.37-1.78]
γ	0.33 [0.14-0.97]	0.42 [0.26-0.68]	0.54 [0.25-0.75]	0.61 [0.25-1.07]

E. Propagation of error

To study error propagation, we performed two simulations studies and we also re-analyzed the data allowing for serial correlation in the responses.

E.1 Simulation studies

In the trade-off method previous responses are used in the elicitation of subsequent choices. This feature of the method yields chained answers and may lead to error propagation because errors made in one particular choice affect later choices. We checked for the impact of error propagation using the simulation methods developed by Bleichrodt and Pinto (2000) and Abdellaoui et al. (2005).

Following Bleichrodt & Pinto (2000), we performed two simulation studies based on two different error specifications. In the first simulation, we assumed that in evaluating the trade-off questions, the subject made an error in his assessment of utility differences. We assumed that the response error ε was a proportion of the true utility difference. In that case, the assessed utility difference is equal to $(1+\ \varepsilon)$ times the true utility difference. We assumed the error term to be normally distributed with mean zero and standard deviation 0.05 and performed 500 simulations. For each participant, we computed 500 simulated standard sequences corresponding to the sequence of utilities {0; 1/5; 2/5 ; 3/5 ; 4/5 ; 5/5}. Simulated standard sequences were determined using linear interpolation.

In the second simulation, we assumed that while participants correctly assessed utility differences, they made an error in reporting their response. We assumed that the response error ε was a proportion of the true indifference outcome. That is, the reported indifference outcome $\overline{x_t^i}$ is equal to $(1+\varepsilon)$ times the true indifference value x_t^i, $i=+,-$ and $t=1,\ldots,5$. In this case, the difference between two successive reported indifference outcomes $\overline{x_{t+1}^i}-\overline{x_t^i}$ is equal to $(1+\varepsilon)$ times the difference between two successive true indifference value $x_{t+1}^i-x_t^i$. The standard sequence of the true indifference values follows the dynamic equation: $x_{t+1}^i = x_t^i + (\overline{x_{t+1}^i} - \overline{x_t^i})/(1 + \varepsilon_t)$, $i = +, -$, $t = 1, \ldots, 4$. We assumed that the error term was normally distributed with mean zero and standard deviation 0.05 and performed 500 simulations.

Tables E-1 and E-2 show that the resulting error in the outcomes of the standard sequence is small. Hence, error propagation was not much of a problem. For both simulations, we also took the simulated standard sequences to compute simulated decision weights based on linear interpolation. Tables E-3 and E-4 show these results. Again, the error in the decision weights is small.

Table E- 1: Results of the simulation study assuming error in the assessed utility difference

The table depicts the average standard deviations of the errors in the outcomes of the standard sequence as a proportion of the corresponding outcomes.

	Professional		Recreational	
	Gains	Losses	Gains	Losses
x_1^i	11.41%	7.97%	7.59%	4.89%
x_2^i	4.83%	4.26%	4.73%	4.40%
x_3^i	4.36%	4.03%	3.81%	4.23%
x_4^i	3.82%	3.87%	3.41%	3.91%
x_5^i	1.70%	1.56%	1.54%	1.66%

Table E- 2: Results of the simulation study assuming error in the reported indifference outcome

The table depicts the average standard deviations of the errors in the outcomes of the standard sequence as a proportion of the corresponding outcomes.

	Professional		Recreational	
	Gains	Losses	Gains	Losses
x_1^i	5.04%	5.06%	5.10%	5.04%
x_2^i	4.03%	3.84%	3.89%	3.86%
x_3^i	3.60%	3.21%	3.35%	3.36%
x_4^i	3.17%	2.89%	2.96%	2.98%
x_5^i	2.79%	2.67%	2.69%	2.76%

Table E- 3: Results of the simulation study assuming error in the assessed utility difference, decision weights

The table depicts the average standard deviations of the errors in the decision weights as a proportion of the corresponding elicited decision weights.

	Professional		Recreational	
	Gains	Losses	Gains	Losses
$p = 0.05$	4.05%	4.68%	4.58%	4.07%
$p = 0.33$	3.22%	3.72%	3.56%	3.72%
$p = 0.50$	2.87%	3.44%	3.29%	3.01%
$p = 0.67$	2.96%	3.15%	2.97%	2.89%
$p = 0.95$	3.13%	2.61%	2.23%	2.76%

Table E- 4: Results of the simulation study assuming error in the reported indifference outcome , decision weights

The table depicts the average standard deviations of the errors in the decision weights as a proportion of the corresponding elicited decision weights.

	Professional		Recreational	
	Gains	Losses	Gains	Losses
$p = 0.05$	3.61%	4.51%	4.19%	4.43%
$p = 0.33$	2.89%	3.35%	3.53%	4.17%
$p = 0.50$	2.55%	3.38%	3.79%	3.12%
$p = 0.67$	2.78%	4.29%	3.14%	3.20%
$p = 0.95$	6.15%	3.58%	3.05%	3.83%

E.2 Parametric analysis of utility accounting for serial correlation in the error terms

We also checked for the impact of error propagation by assuming that the error terms in the utility elicitation were serially correlated. We estimated the unknown utility parameter θ, appearing in the nonlinear regression equation:

$$y_t = U\left(x_t^i, \theta\right) + \epsilon_t$$

$i = +, -$, $t = 1, \dots, 5$.

We assumed that the disturbance term ϵ_t was an autogressive AR(1) process :

$$\epsilon_{t+1} + \rho \epsilon_t = e_t$$

Following Gallant and Goebel (1975), the joint estimation of θ and ρ required the following steps :

1. We computed the ordinary least square estimator $\hat{\theta}$, reported in the main text.
2. We computed the ordinary least square residuals $\hat{\epsilon}_t = y_t - u\left(x_t, \hat{\theta}\right)$ and from these residuals $\hat{\epsilon}_t$ we computed the autocovariances for the underlying autoregressive process :
$$\hat{\gamma}(0) = \frac{1}{n}\sum_{t=1}^{n} \hat{\epsilon}_t \hat{\epsilon}_t$$
$$\hat{\gamma}(1) = \frac{1}{n}\sum_{t=1}^{n-1} \hat{\epsilon}_t \hat{\epsilon}_{t+1}$$
3. We built the variance-covariance matrix of the AR(1) process from the autocovariances :
$$\hat{\Gamma} = \begin{bmatrix} \hat{\gamma}(0) & \hat{\gamma}(1) \\ \hat{\gamma}(1) & \hat{\gamma}(0) \end{bmatrix}$$
and used the Yulle-Walker equations to get:
$$\hat{a} = -\hat{\Gamma}^{-1} . \hat{\gamma}(1)$$
$$\hat{\sigma}^2 = \hat{\gamma}(0) + \hat{a} . \hat{\gamma}(1)$$
4. We factored the inverse of the variance-covariance matrix of the AR(1) process $\hat{\Gamma}^{-1}$ using a Cholesky factorization $\hat{\Gamma}^{-1} = \hat{Q}'\hat{Q}$ and set :

$$\hat{P} = \begin{bmatrix} \sigma.\hat{Q} & 0 & \dots & 0 \\ a_1 & 1 & & \\ & \ddots & \ddots & \\ & & a_1 & 1 \end{bmatrix}$$

where $\hat{P}$ has n rows and then n-1 rows with $a_1's$ and 1's. Then we found the estimator $\tilde{\theta}$ that minimized:

$$\frac{1}{n}\left(\hat{P}.y - \hat{P}.u(x_t, \theta)\right)'\left(\hat{P}.y - \hat{P}.u(x_t, \theta)\right)$$

Table E-5 shows the individual results from this estimation. The obtained parameters are very close to the ones reported in the main text and the correlations are almost perfect (> 0.90). Hence, we observe once again that the chained nature of our measurements had no effect on the results.

Table E-5: Summary of individual parametric fittings of utility in the first experiment, accounting for serial correlation in the error terms

The table depicts the results of fitting power functions on each subject's choices individually accounting for serial correlation in the error terms. Shown are the median and interquartile range (IQR) for the resulting estimates. The power coefficients of utility between parametric fittings shown in the main text and estimates accounting for serial correlation in the error terms were highly correlated: in any case, Kendall's tau were higher than 0.9.

	Professional		Recreational	
	Gains	Losses	Gains	Losses
Median	0.67	0.83	0.80	0.83
IQR	[0.50-0 .85]	[0.64-1.14]	[0.64-1.06]	[0.58-0.99]

F. Probability weights under linear utility

Table F-1: Median decision weights assuming linear utility

	Professional		Recreational	
	Gains	Losses	Gains	Losses
$p = 0.05$	0.10**	0.09	0.09*	0.08
$p = 0.33$	0.35*	0.20**	0.26*	0.31
$p = 0.50$	0.45**	0.33*	0.34	0.51
$p = 0.67$	0.56*	0.41	0.44	0.58
$p = 0.95$	0.81*	0.68	0.80	0.77

Notes : Wilcoxon matched pairs test on the difference between decision weight under linear and nonlinear utility, * significant at 5% level; ** significant at 1% level

Table F-1 shows the medians of individual decision weights for gains and losses under the assumption that utility is linear. Because utility for gains was rather concave for the professionals, assuming linear utility led to significant differences in the elicited decision weights. There were also some differences in decision weights for losses for the professional players and for gains for the recreational players.

Table F-2 shows the medians of the individual estimates of the Prelec two-parameter weighting function assuming linear utility. As expected, the parameters changed compared to those reported in the main text, but, as before the professionals were more optimistic for gains (one tail Mann-Whitney test, $p = 0.04$). The professionals were also more optimistic for losses (one tail Mann-Whitney test, $p = 0.02$. The sensitivity to changes in the probability of losses was marginally higher in the recreational group (one tail Mann-Whitney test, $p = 0.08$).

Table F-2: Median probability weighting function parameters assuming linear utility

The table shows the median estimated parameters of the Prelec probability weighting function for gains and for losses and their interquartile ranges, for both groups.

	Professional Group		Recreational Group	
Parameter	Gains	Losses	Gains	Losses
δ	1.05 [067-1.56]	1.31 [1.03-1.76]	1.39 [0.87-1.99]	1.00 [0.89-1.22]
γ	0.48 [0.20-0.73]	0.40 [0.23-0.65]	0.51 [0.32-0.74]	0.60 [0.36-0.80]

G. Cross-validation analysis

We checked the robustness of our estimates by cross validation. We used two methods : the standard leave-one-out cross validation (LOOCV) and a leave-but-3-out cross validation (L3OCV). The first method uses one observation as the validation set and the remaining observations as the training set. The second method uses only 2 data points to obtain deterministic parameter estimates (1 data point + point (1,1) to determine the parameter of the power utility function and 2 data points to determine Prelec's two parameter probability weighting function).

Table G-1 shows the power (CRRA) utility parameter based on the median data using the full dataset (column 2) and the averages of the LOOCV and L3OCV estimates. The bias is minimal even for L3OCV where only 2 data points are used. The standard deviations show that the precision of the estimation is better for losses than for gains, but even for gains the precision is high with a maximal standard deviation of 0.04 in the L3OCV.

Table G-1: Cross validation results for power (CRRA) utility based on the median data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Gains	0.71	0.71	0.0164	0.71	0.0433
	Losses	0.83	0.83	0.0097	0.82	0.0136
Recreational players	Gains	0.79	0.79	0.0106	0.79	0.0239
	Losses	0.84	0.84	0.0050	0.83	0.0066

Tables G-2 and G-3 show the parameter estimates of the Prelec 2-parameter weighting function based on the median data using the full dataset (column 2) and the averages of the LOOCV and L3OCV estimates. The bias is again minimal. For gains, the reliability of the estimates is good. For losses, the precision of the estimates is less than for gains. It is still satisfactory in the LOOCV, but in the L3OCV the estimates are much more unreliable, particularly those for curvature.

Table G-2: Cross validation results for Prelec's two-parameter probability weighting function for gains based on the median data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Elevation	0.70	0.69	0.0215	0.68	0.0538
	Curvature	0.45	0.45	0.0476	0.46	0.0934
Recreationals	Elevation	1.19	1.19	0.0232	1.18	0.0895
	Curvature	0.56	0.56	0.0225	0.54	0.0912

Table G-3: Cross validation results for Prelec's two-parameter probability weighting function for losses based on the median data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Elevation	1.08	1.08	0.0591	1.04	0.1623
	Curvature	0.47	0.47	0.0671	0.50	0.2483
Recreationals	Elevation	0.93	0.93	0.0632	0.91	0.2311
	Curvature	0.86	0.85	0.0905	0.81	0.3944

Tables G-4 to G-6 show the results based on the individual data. Table G-4 shows the medians of the individual power (CRRA) utility parameters based on the full data (column 2) and based on the averages of the LOOCV and the L3OCV estimates.

Table G-4: Cross validation results for power (CRRA) utility based on the individual data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Gains	0.69	0.69	0.0377	0.66	0.1997
	Losses	0.83	0.83	0.0362	0.79	0.0750
Recreational players	Gains	0.82	0.83	0.0351	0.85	0.1607
	Losses	0.84	0.84	0.0406	0.82	0.0647

Tables G-5 and G-6 show the results for Prelec's two-parameter probability weighting function for gains (G-5) and for losses (G-6). The estimates using the LOOCV ar estill rather precise, but teh estimates using the L3)CV are imprecise.

Table G-5: Cross validation results for Prelec's two-parameter probability weighting function for gains based on the individual data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Elevation	0.66	0.65	0.0740	0.74	0.3528
	Curvature	0.38	0.40	0.1763	0.41	0.5578
Recreationals	Elevation	1.16	1.18	0.1261	1.35	0.4512
	Curvature	0.44	0.44	0.1072	0.41	0.4436

Table G-6: Cross validation results for Prelec's two-parameter probability weighting function for losses based on the individual data.

		Full data	Mean LOOCV	St. Dev. LOOCV	Mean L3OCV	St. Dev. L3OCV
Professionals	Elevation	1.04	1.03	0.1523	1.05	0.5714
	Curvature	0.36	0.35	0.1480	0.41	0.6546
Recreationals	Elevation	0.94	0.92	0.1104	0.91	0.3381
	Curvature	0.70	0.62	0.1636	0.63	0.5675

H. Loss aversion under Köbberling & Wakker's definition of loss aversion

Figure H-1 shows the cumulative distribution functions of the individual loss aversion coefficients under the definition of Köbberling & Wakker (2005). Köbberling and Wakker (2005) defined loss aversion as the kink at the reference point: $U_{\uparrow}^{'}(0)/U_{\downarrow}^{'}(0)$, where $U_{\uparrow}^{'}(0)$ represents the left derivative and $U_{\downarrow}^{'}(0)$ the right derivative of U at the reference point. Our measurements allowed an easy measurement of this kink as $-\frac{x_1^+}{x_1^-}$. The figure shows that most hockey players were loss averse also according to the definition of Köbberling and Wakker (2005). Moreover, loss aversion was similar in the professional and in the recreational groups (Kolmogorov-Smirnov test, $p = 0.78$).

Figure H-1: The cumulative distribution function of the individual loss aversion coefficients under Köbberling and Wakker's (2005) definition of loss aversion