ONLINE APPENDIX

A Model Extensions and Illustrations

A.1 Nonlinear Version

We now allow the rational action to be a nonlinear function of x, so that

$$a^r = A(x). \tag{18}$$

We make the simplifying assumptions that, first, the agent still chooses an action based on the posterior expectation about x, as has been done in prior literature (Gabaix, 2019),

$$a(s) = A(\mathbb{E}[x|s]), \tag{19}$$

second, that the function A is strictly monotone, such that it can again be identified from the median action a^e,

$$a^e(x) = \text{Median}(a(s)|x) = A(\lambda x + (1-\lambda)x^d), \tag{20}$$

and third, that $x^d = 0$, which is merely a notational simplification. In our empirical applications we will slightly deviate from this and elicit a different type of interval that is wider than the interquartile range, but we here stick to the notation of cognitive uncertainty as denoting one perceived standard deviation around the action for simplicity.

We define cognitive uncertainty analogously to (8) as the agent's perceived uncertainty about his rational action,

$$\sigma_{CU}(x) = \left| A\left(\lambda x + \frac{1}{2}\sqrt{1-\lambda}\sigma_x\right) - A\left(\lambda x - \frac{1}{2}\sqrt{1-\lambda}\sigma_x\right)\right|. \tag{21}$$

At the median, using $a^e(x) = A(\lambda x)$ yields

$$\sigma_{CU}(x) = \left| a^e\left(x + \frac{1}{2}\frac{\sqrt{1-\lambda}}{\lambda}\sigma_x\right) - a^e\left(x - \frac{1}{2}\frac{\sqrt{1-\lambda}}{\lambda}\sigma_x\right)\right|. \tag{22}$$

A Taylor expansion of (22) gives

$$\sigma_{CU} = \left|a^{e\prime}(x)\right| \frac{\sqrt{1-\lambda}}{\lambda}\sigma_x. \tag{23}$$

which is the nonlinear equivalent of equation (8):

$$\frac{\lambda}{\sqrt{1-\lambda}} = \frac{|a^{e\prime}(x)|\,\sigma_x}{\sigma_{CU}}. \tag{24}$$

A.2 Illustration of Model Predictions

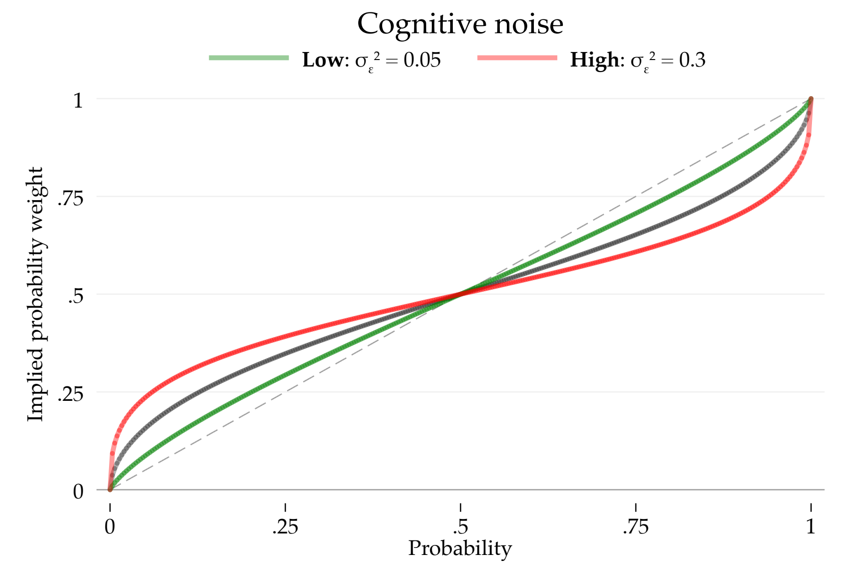


Figure 13: Illustration of model predictions 1 and 2

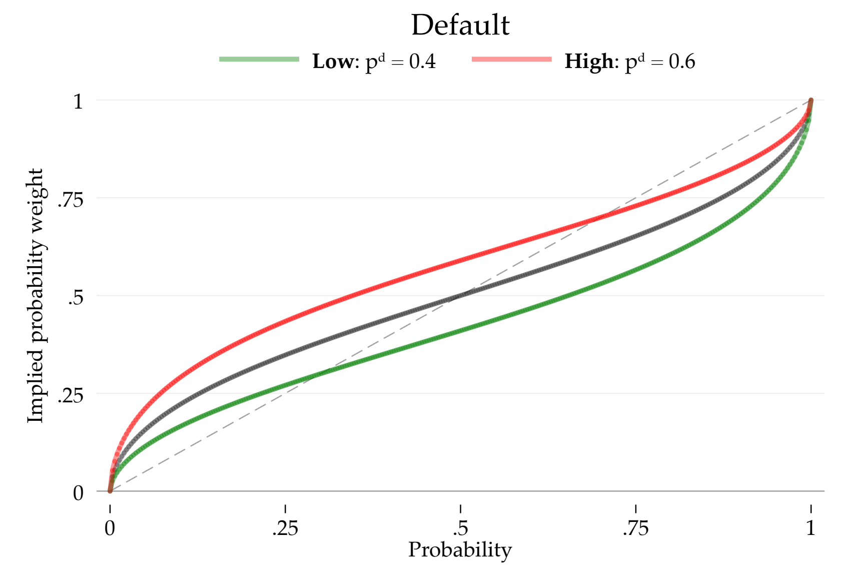


Figure 14: Illustration of model prediction 3

B Additional Details and Analyses for Choice under Risk Experiments

B.1 Additional Figures

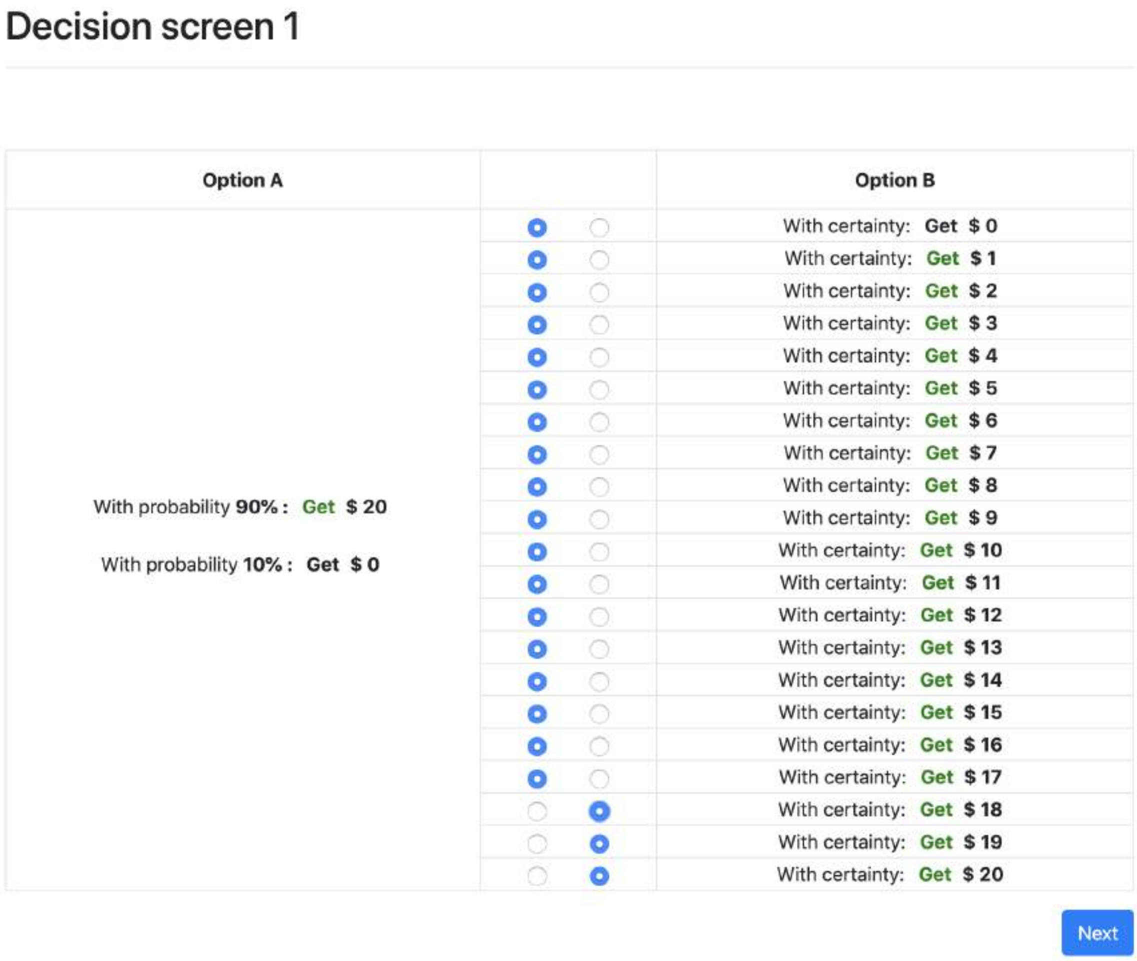


Figure 15: Decision screen to elicit certainty equivalents for lotteries

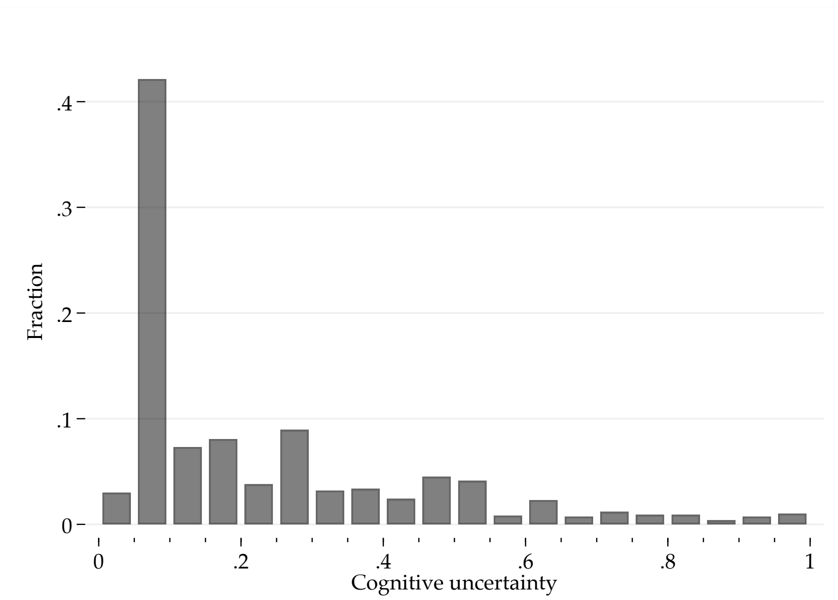


Figure 16: Histogram of cognitive uncertainty in baseline choice under risk tasks

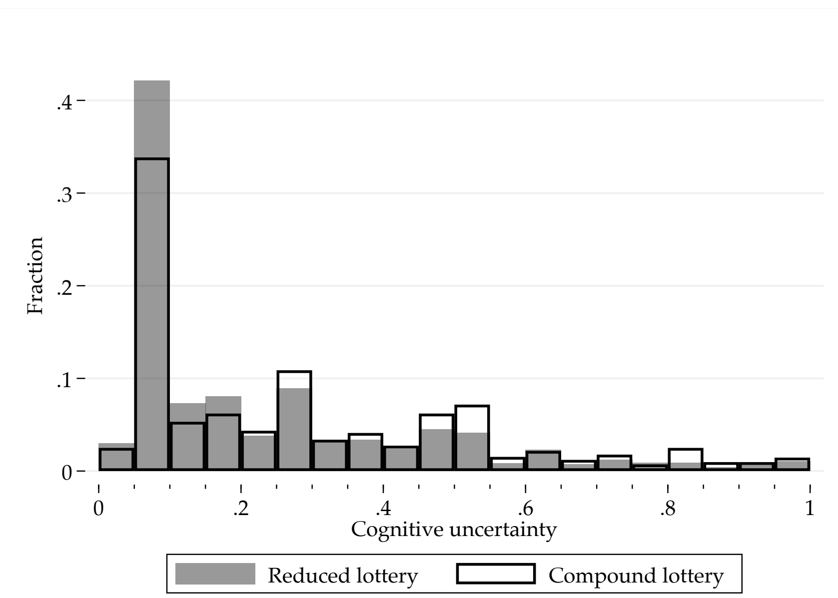


Figure 17: Histograms of cognitive uncertainty in choice under risk tasks, separately for reduced and compound lotteries

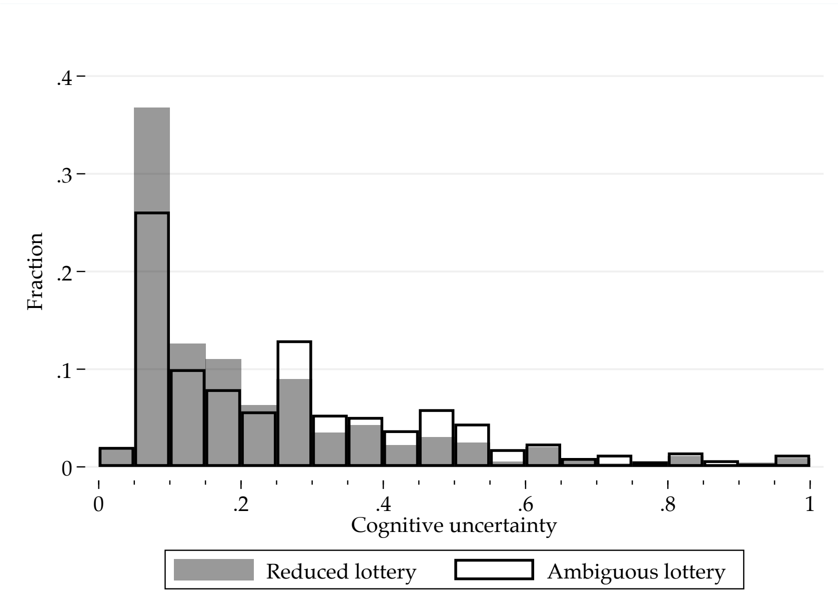


Figure 18: Histograms of cognitive uncertainty in choice under risk tasks, separately for reduced and ambiguous lotteries

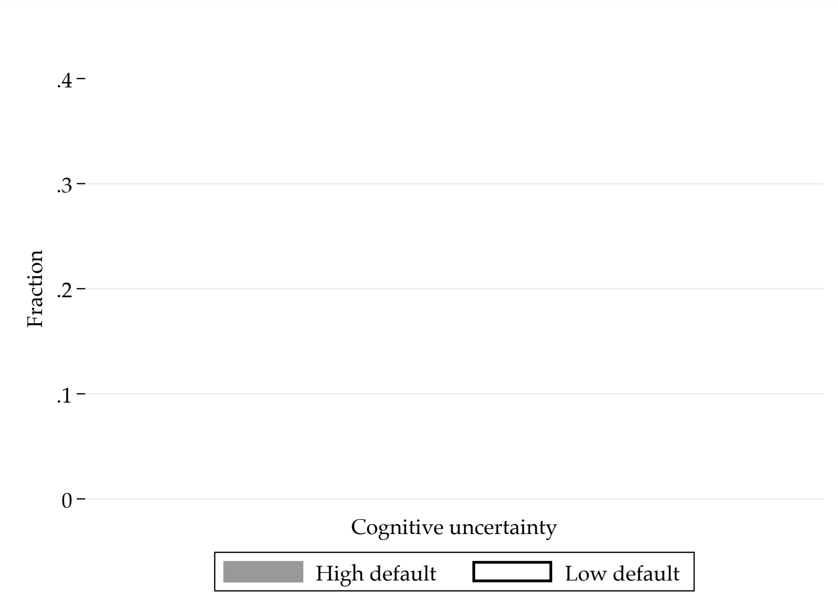


Figure 19: Histograms of cognitive uncertainty in choice under risk tasks, separately for treatments *High Default Risk* and *Low Default Risk*.

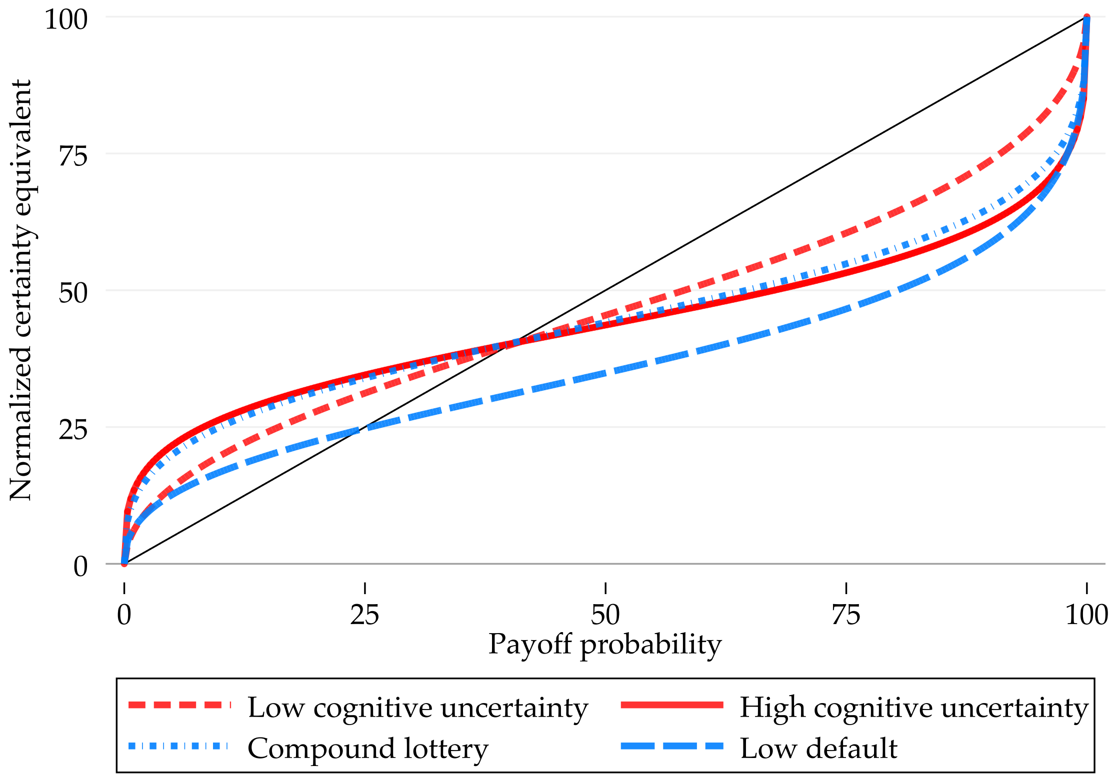


Figure 20: Estimated probability weighting functions across treatments and groups of subjects.

B.2 Results with Full Sample

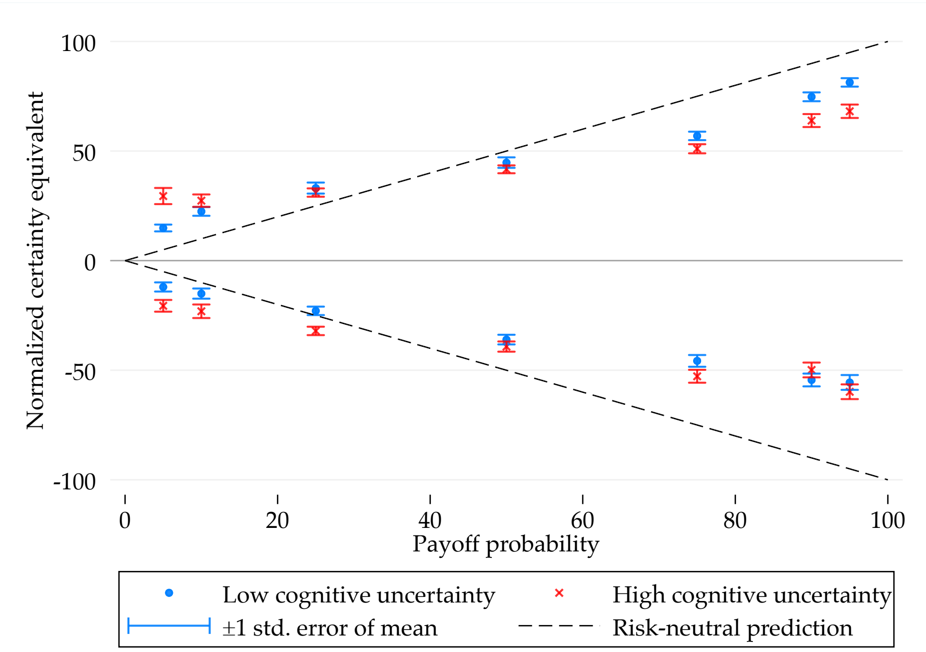


Figure 21: Probability weighting function separately for subjects above / below average cognitive uncertainty (full sample). The partition is done separately for each probability × gains / losses bucket. The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 2,601 certainty equivalents of 700 subjects.

Table 8: Insensitivity to probability and cognitive uncertainty (full sample)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of payout	0.74***	0.73***	0.51***	0.51***	0.63***	0.63***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
Probability of payout × Cognitive uncertainty	-0.68***	-0.68***	-0.29***	-0.28***	-0.49***	-0.49***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.07)	(0.07)
Cognitive uncertainty	25.1***	25.3***	28.5***	27.7***	27.6***	28.0***
	(6.17)	(6.17)	(5.68)	(5.75)	(4.35)	(4.37)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	1286	1286	1315	1315	2601	2601
R^2	0.49	0.50	0.28	0.29	0.36	0.36

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from all baseline gambles with strictly interior probabilities. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

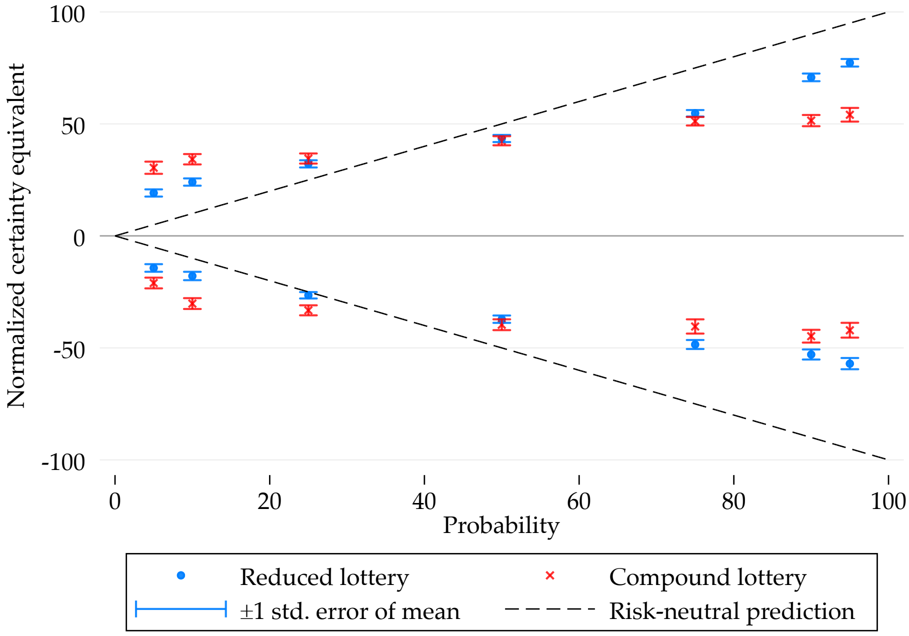


Figure 22: Probability weighting function separately for reduced and compound lotteries (full sample). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 3,905 certainty equivalents of 700 subjects.

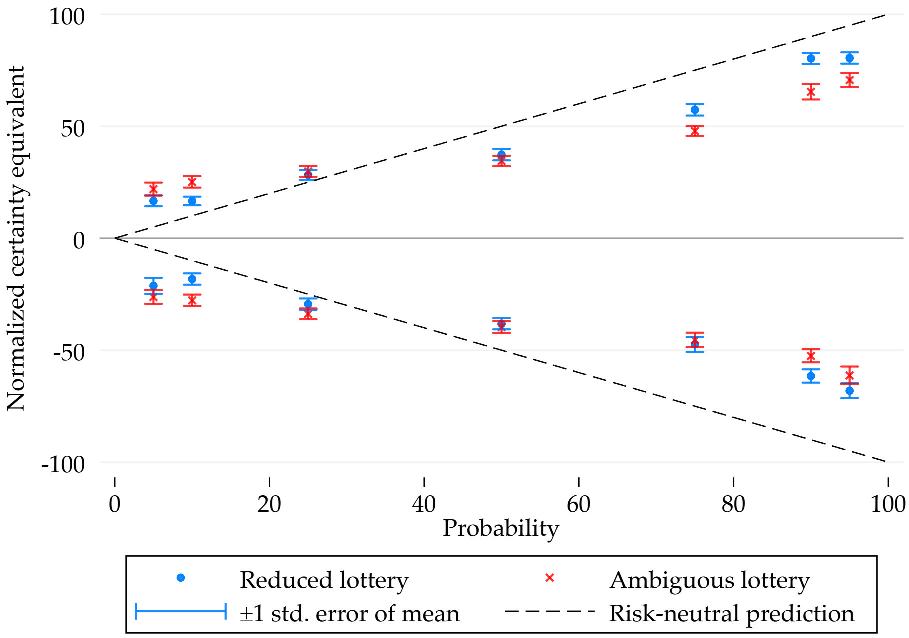


Figure 23: "Probability" weighting function separately for reduced and ambiguous lotteries (full sample). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 1,800 certainty equivalents of 300 subjects.

Table 9: Choice under risk: Baseline versus compound lotteries (full sample)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of payout	0.59***	0.70***	0.45***	0.50***	0.52***	0.61***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)
Probability of payout × 1 if compound lottery	-0.34***	-0.31***	-0.25***	-0.23***	-0.29***	-0.27***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Probability of payout × Cognitive uncertainty		-0.49***		-0.24***		-0.38***
		(0.08)		(0.08)		(0.06)
1 if compound lottery	13.6***	12.6***	12.3***	10.5***	12.9***	11.7***
	(2.09)	(2.08)	(1.98)	(1.99)	(1.46)	(1.44)
Cognitive uncertainty		19.3***		24.8***		22.9***
		(4.87)		(4.67)		(3.70)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	1958	1958	1947	1947	3905	3905
R^2	0.37	0.40	0.21	0.24	0.28	0.30

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from the baseline and compound gambles, where for comparability the set of baseline gambles is restricted to gambles with payout probabilities of 10%, 25%, 50%, 75%, and 90%, see Figure 4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Choice under risk: Treatments *Low Default* and *High Default* (full sample)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
0 if *High Default*, 1 if *Low Default*	-12.1***	-11.5***	-2.96	-2.63	-7.53***	-7.05***
	(1.93)	(1.98)	(2.24)	(2.22)	(1.58)	(1.58)
Probability of payout	0.59***	0.60***	0.54***	0.54***	0.57***	0.57***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)
Probability of payout × Cognitive uncertainty	-0.53***	-0.53***	-0.38***	-0.39***	-0.43***	-0.45***
	(0.12)	(0.12)	(0.13)	(0.14)	(0.09)	(0.10)
Cognitive uncertainty	23.2***	23.1***	39.7***	39.6***	31.2***	31.1***
	(6.00)	(6.01)	(7.64)	(7.90)	(5.14)	(5.26)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	900	900	900	900	1800	1800
R^2	0.34	0.35	0.25	0.27	0.27	0.29

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from treatments *Low Default* and *High Default*. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

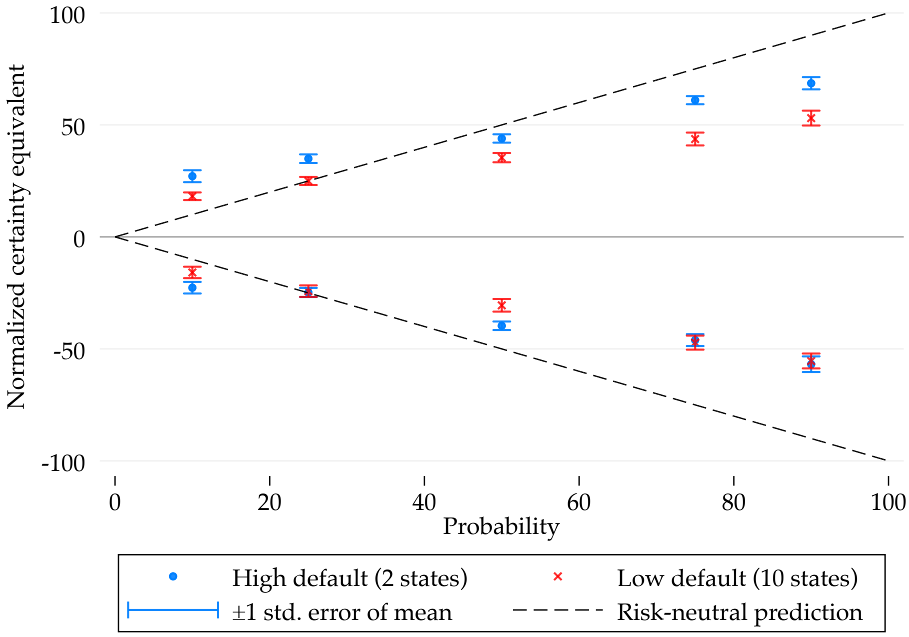


Figure 24: Probability weighting function separately for treatments *High Default Risk* and *Low Default Risk* (full sample). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 1,800 certainty equivalents of 700 subjects.

B.3 Results excluding Speeders

Table 11: Insensitivity to probability and cognitive uncertainty (excl. speeders)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of payout	0.74***	0.74***	0.52***	0.51***	0.64***	0.64***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
Probability of payout × Cognitive uncertainty	-0.70***	-0.70***	-0.32***	-0.30***	-0.52***	-0.51***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.08)	(0.08)
Cognitive uncertainty	26.6***	27.1***	29.3***	28.3***	28.8***	29.1***
	(6.61)	(6.55)	(5.84)	(5.90)	(4.57)	(4.58)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	1162	1162	1187	1187	2349	2349
R^2	0.49	0.50	0.28	0.29	0.36	0.37

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from all baseline gambles with strictly interior probabilities. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

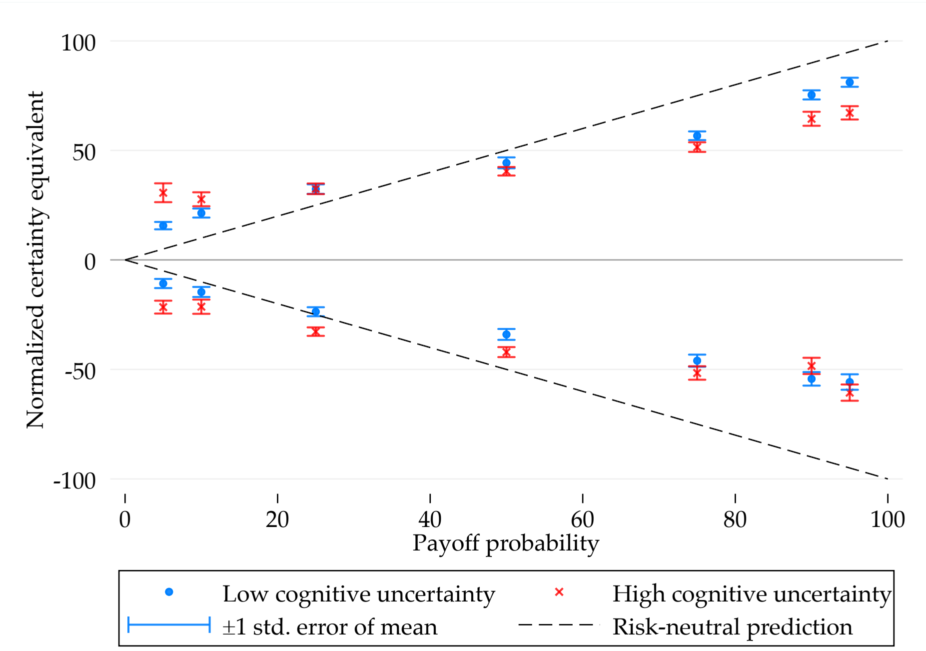


Figure 25: Probability weighting function separately for subjects above / below average cognitive uncertainty (excl. speeders). The partition is done separately for each probability × gains / losses bucket. The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 2,349 certainty equivalents of 630 subjects.

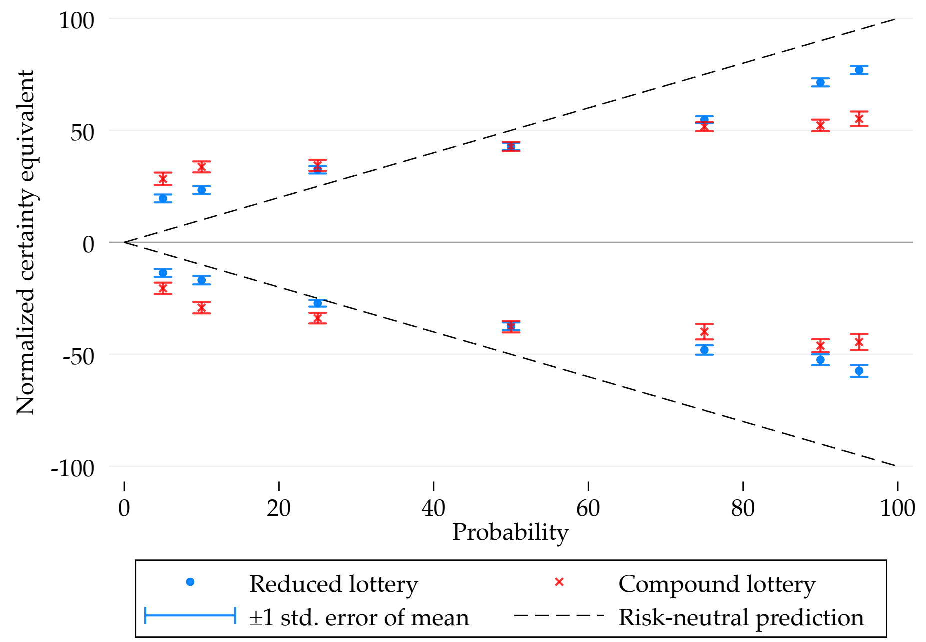


Figure 26: Probability weighting function separately for reduced and compound lotteries (excl. speeders). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 3,519 certainty equivalents of 700 subjects.

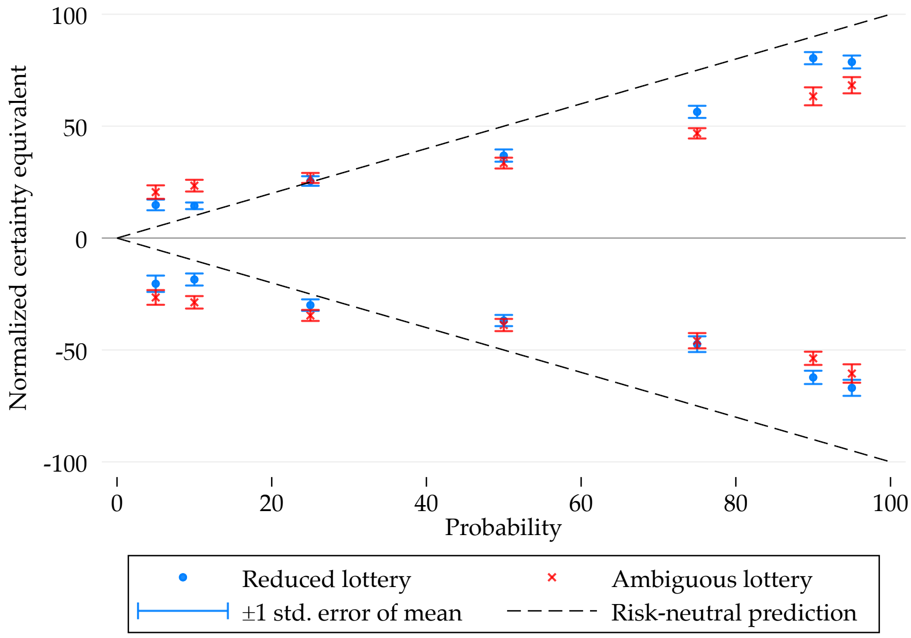


Figure 27: "Probability" weighting function separately for reduced and ambiguous lotteries (excl. speeders). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 1,608 certainty equivalents of 268 subjects.

Table 12: Choice under risk: Baseline versus compound lotteries (excl. speeders)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of payout	0.59***	0.70***	0.46***	0.51***	0.53***	0.61***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Probability of payout × 1 if compound lottery	-0.32***	-0.29***	-0.23***	-0.21***	-0.27***	-0.25***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Probability of payout × Cognitive uncertainty		-0.49***		-0.26***		-0.39***
		(0.08)		(0.08)		(0.06)
1 if compound lottery	12.5***	11.5***	11.6***	9.55***	12.0***	10.7***
	(2.18)	(2.18)	(2.05)	(2.06)	(1.52)	(1.50)
Cognitive uncertainty		19.9***		25.7***		23.6***
		(5.23)		(4.92)		(3.95)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	1766	1766	1753	1753	3519	3519
R^2	0.38	0.40	0.22	0.25	0.29	0.30

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from the baseline and compound gambles, where for comparability the set of baseline gambles is restricted to gambles with payout probabilities of 10%, 25%, 50%, 75%, and 90%, see Figure 4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

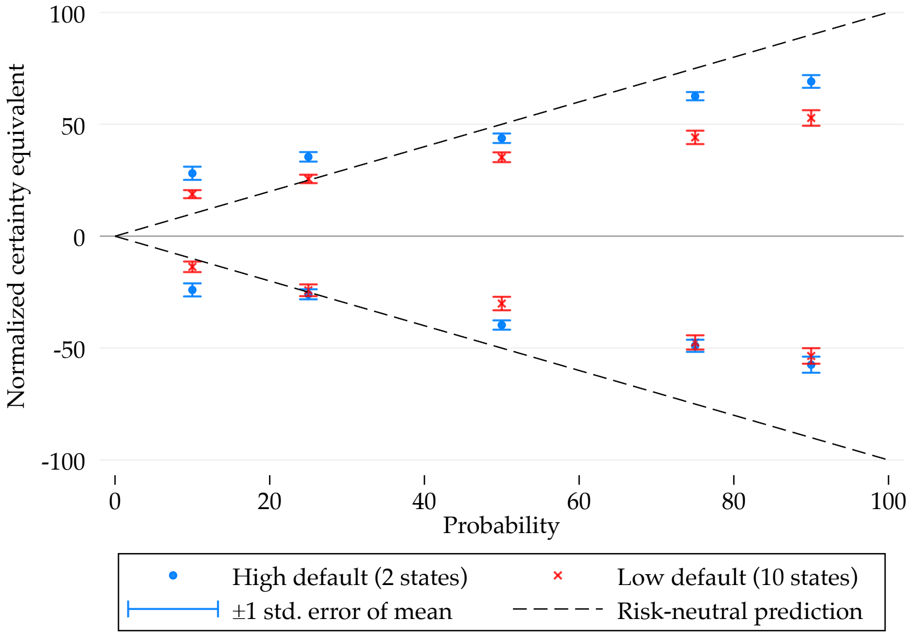


Figure 28: Probability weighting function separately for treatments *High Default Risk* and *Low Default Risk* (excl. speeders). The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure is based on 1,620 certainty equivalents of 270 subjects.

Table 13: Choice under risk: Treatments *Low Default* and *High Default* (excl. speeders)

	Dependent variable: Absolute normalized certainty equivalent					
	Gains		Losses		Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
0 if *High Default*, 1 if *Low Default*	-12.5***	-12.1***	-4.86**	-4.53*	-8.67***	-8.24***
	(2.06)	(2.12)	(2.35)	(2.35)	(1.68)	(1.69)
Probability of payout	0.59***	0.59***	0.54***	0.55***	0.57***	0.57***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)
Probability of payout × Cognitive uncertainty	-0.54***	-0.53***	-0.36***	-0.38***	-0.44***	-0.45***
	(0.13)	(0.13)	(0.14)	(0.14)	(0.10)	(0.10)
Cognitive uncertainty	22.6***	22.1***	39.3***	39.0***	31.2***	31.2***
	(6.60)	(6.57)	(7.82)	(8.11)	(5.38)	(5.47)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	810	810	810	810	1620	1620
R^2	0.33	0.35	0.26	0.28	0.28	0.29

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's normalized certainty equivalent, computed as midpoint of the switching interval divided by the non-zero payout. The sample includes choices from treatments *Low Default* and *High Default*. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Additional Details and Analyses for Belief Updating Experiments

C.1 Additional Figures

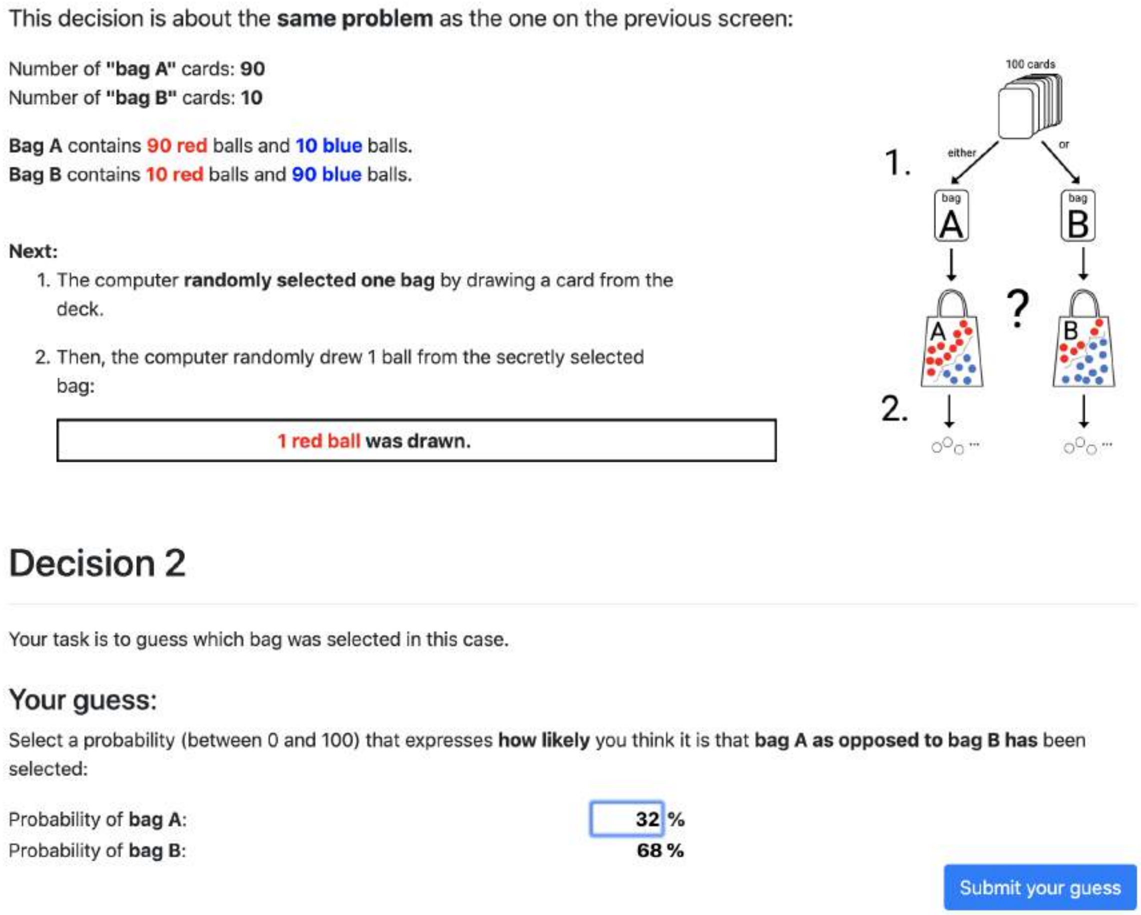


Figure 29: Decision screen to elicit posterior belief in belief updating tasks

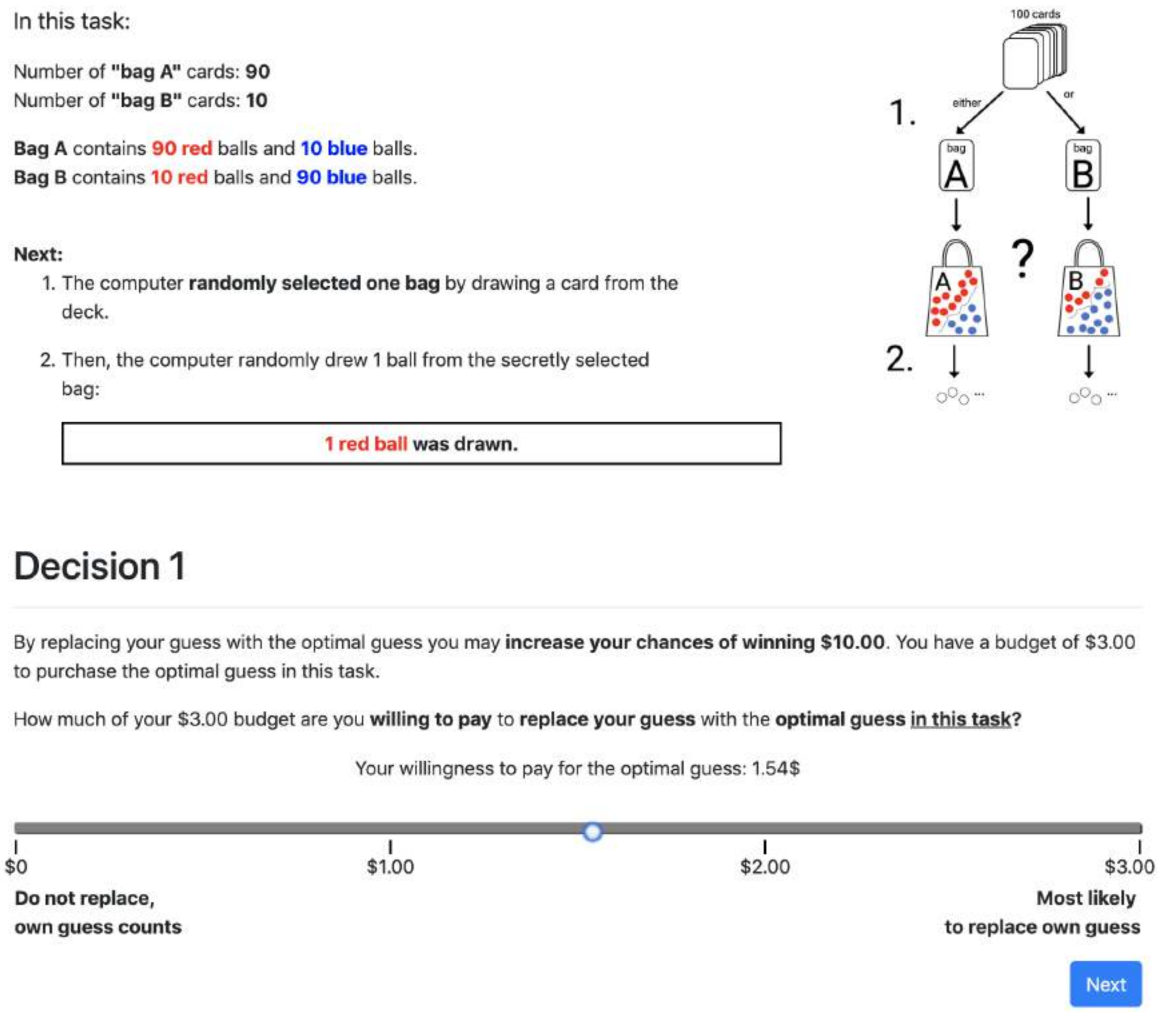


Figure 30: Decision screen to elicit willingness-to-pay for optimal guess in belief updating

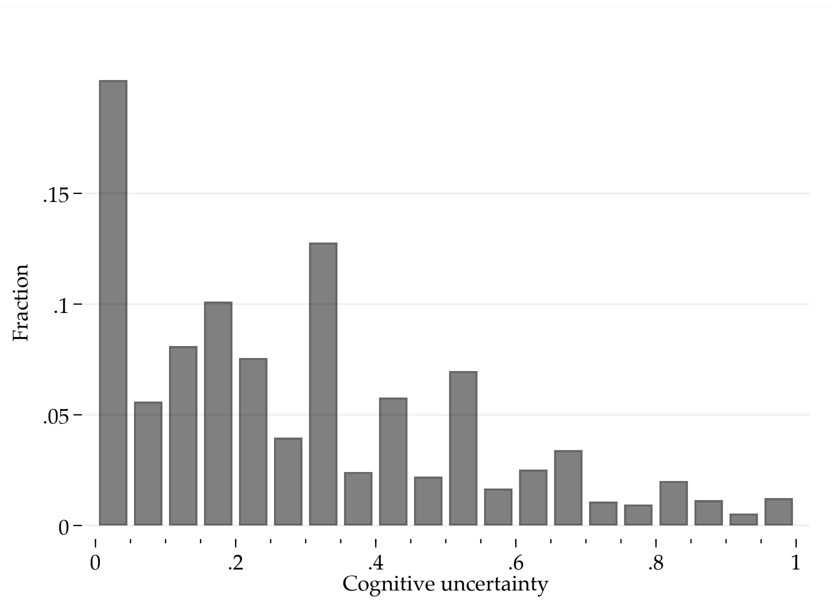


Figure 31: Histogram of cognitive uncertainty in baseline belief updating tasks

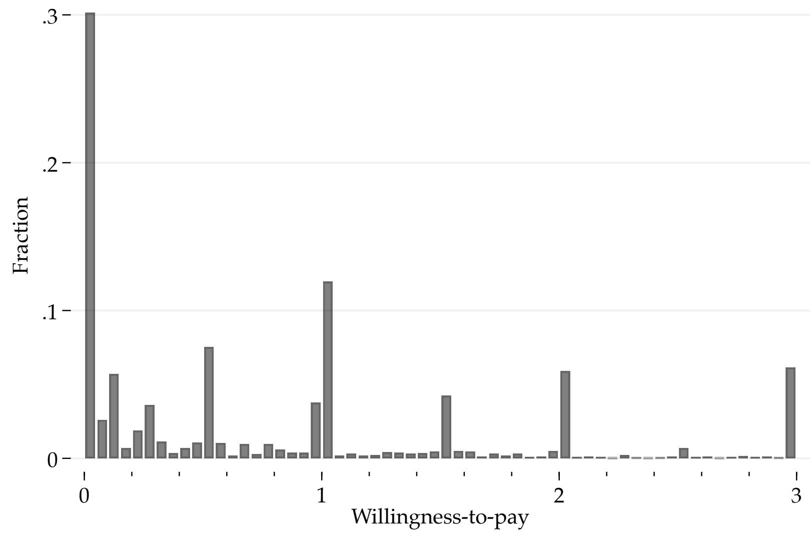


Figure 32: Histogram of willingness-to-pay to replace own guess by Bayesian posterior in baseline belief updating tasks

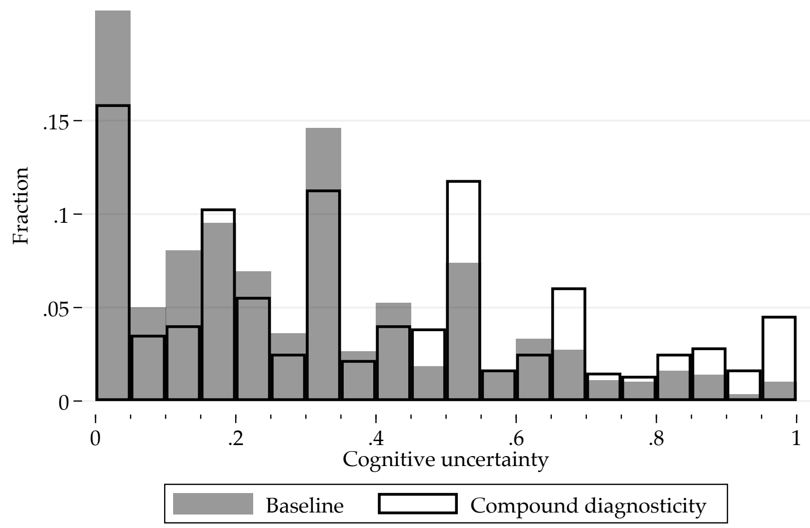


Figure 33: Histograms of cognitive uncertainty in belief updating tasks, separately for baseline and compound diagnosticities

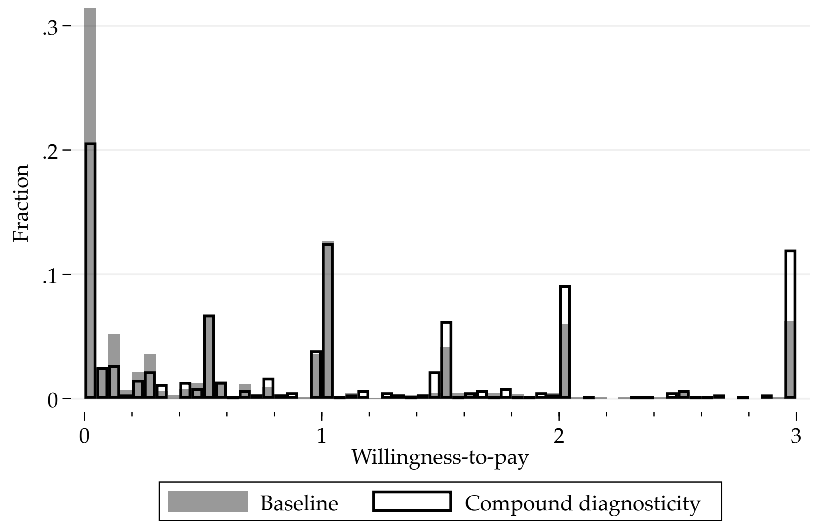


Figure 34: Histograms of willingness-to-pay to replace own guess by Bayesian posterior in belief updating tasks, separately for baseline and compound diagnosticities

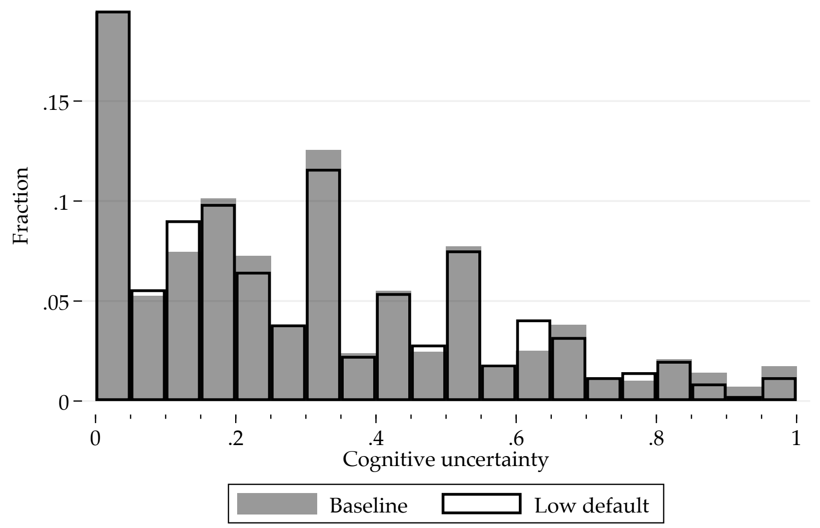


Figure 35: Histograms of cognitive uncertainty in belief updating tasks, separately for treatments *Baseline* and *Low Default Beliefs*.

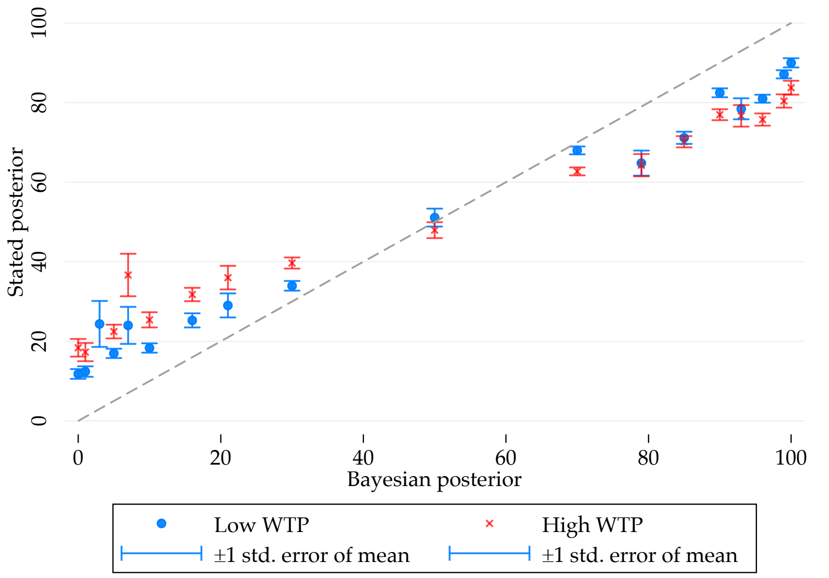


Figure 36: Relationship between stated and Bayesian posteriors, separately for subjects above / below median WTP for the Bayesian guess. The partition is done separately for each Bayesian posterior. The plot shows averages and corresponding standard error bars.

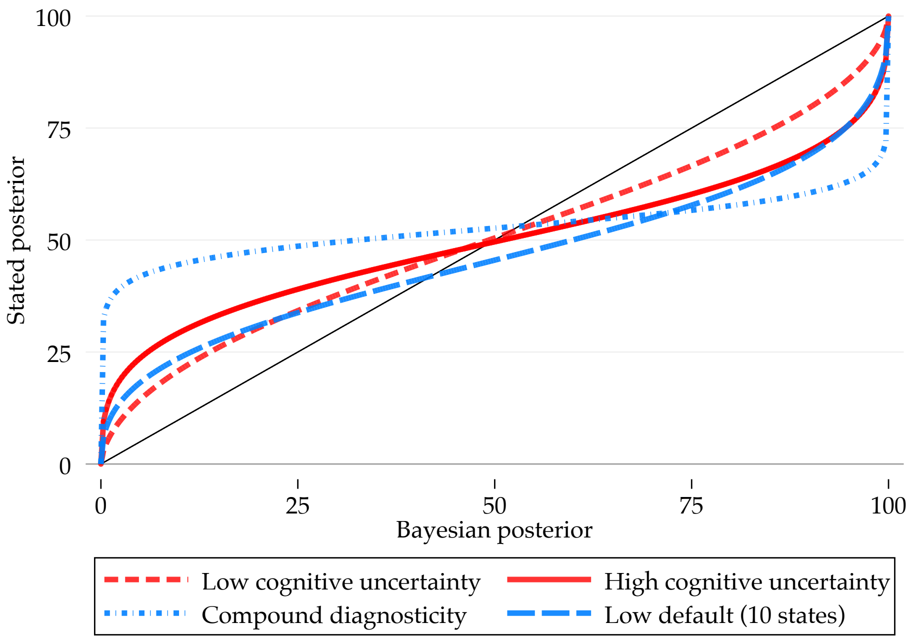


Figure 37: Estimated belief weighting functions across treatments and groups of subjects.

C.2 Additional Tables

Table 14: Belief updating: Baseline tasks: WTP measure

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
Bayesian posterior	0.69***	0.76***	0.76***			
	(0.01)	(0.01)	(0.01)			
Bayesian posterior × WTP for Bayes		-0.096***	-0.096***			
		(0.01)	(0.01)			
WTP for Bayesian posterior		5.49***	5.47***		0.027	0.024
		(0.76)	(0.76)		(0.02)	(0.02)
Log [Likelihood ratio]				0.41***	0.43***	0.43***
				(0.01)	(0.01)	(0.01)
Log [Prior odds]				0.42***	0.44***	0.44***
				(0.02)	(0.03)	(0.03)
Log [Likelihood ratio] × WTP for Bayes					-0.042***	-0.043***
					(0.01)	(0.01)
Log [Prior odds] × WTP for Bayes					-0.028	-0.027
					(0.02)	(0.02)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	3187	3187	3187	3104	3104	3104
R^2	0.72	0.73	0.73	0.62	0.63	0.63

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.3 Results with Full Sample

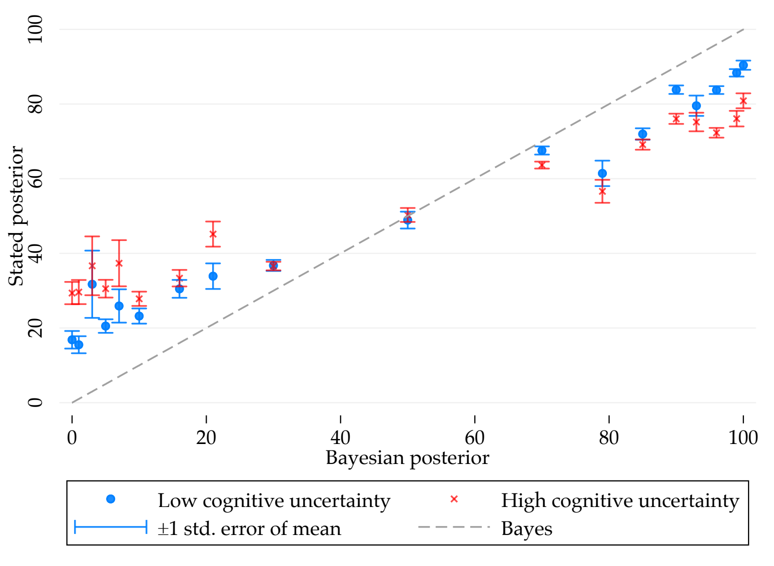


Figure 38: Relationship between average stated and Bayesian posteriors, separately for subjects above / below average cognitive uncertainty (full sample). The partition is done separately for each Bayesian posterior. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 3,310 beliefs of 700 subjects.

Table 15: Belief updating: Baseline tasks (full sample)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
Bayesian posterior	0.62***	0.77***	0.77***			
	(0.01)	(0.02)	(0.02)			
Bayesian posterior × Cognitive uncertainty		-0.56***	-0.56***			
		(0.05)	(0.05)			
Cognitive uncertainty		25.3***	25.3***		-0.12	-0.12
		(3.15)	(3.18)		(0.08)	(0.08)
Log [Likelihood ratio]				0.36***	0.42***	0.42***
				(0.01)	(0.02)	(0.02)
Log [Prior odds]				0.36***	0.51***	0.51***
				(0.02)	(0.03)	(0.03)
Log [Likelihood ratio] × Cognitive uncertainty					-0.28***	-0.28***
					(0.05)	(0.05)
Log [Prior odds] × Cognitive uncertainty					-0.55***	-0.54***
					(0.07)	(0.07)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	3310	3310	3310	3222	3222	3222
R^2	0.57	0.60	0.60	0.48	0.51	0.51

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

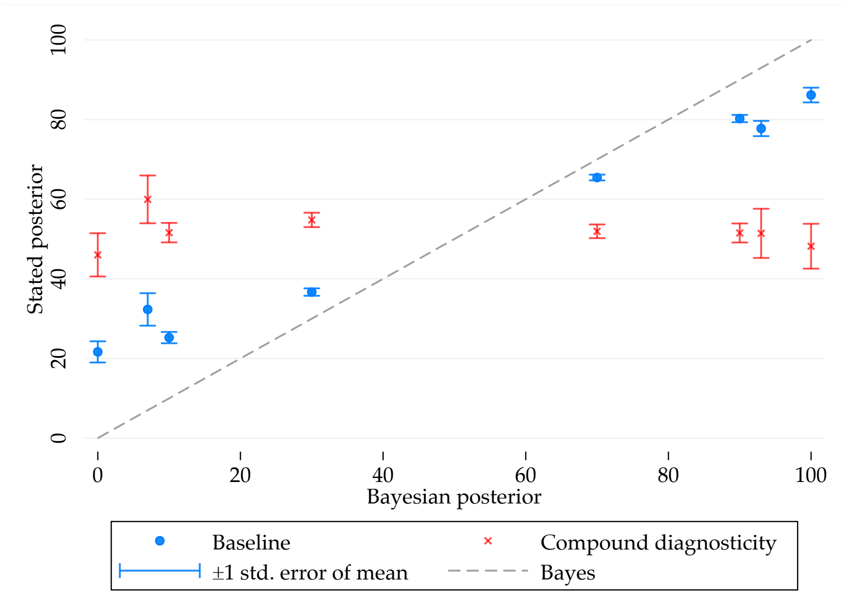


Figure 39: Stated average posteriors as a function of Bayesian posteriors, separately for reduced and compound belief updating problems (full sample). The plot shows averages and corresponding standard error bars. To allow for a valid comparison between baseline and compound updating problems, the sample is restricted to updating tasks in which the base rate is 50:50. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 2,056 beliefs of 697 subjects.

Table 16: Belief updating: Reduced versus compound signal diagnosticities (full sample)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
Bayesian posterior	0.44***	0.67***	0.67***			
	(0.02)	(0.02)	(0.02)			
Bayesian posterior × 1 if compound problem		-0.69***	-0.69***			
		(0.04)	(0.04)			
1 if compound problem		34.5***	34.7***		-0.046	-0.043
		(2.17)	(2.15)		(0.06)	(0.06)
Log [Likelihood ratio]				0.31***	0.40***	0.40***
				(0.01)	(0.02)	(0.02)
Log [Likelihood ratio] × 1 if compound problem					-0.32***	-0.32***
					(0.03)	(0.03)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	2056	2056	2056	1954	1954	1954
R^2	0.29	0.45	0.46	0.33	0.40	0.41

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

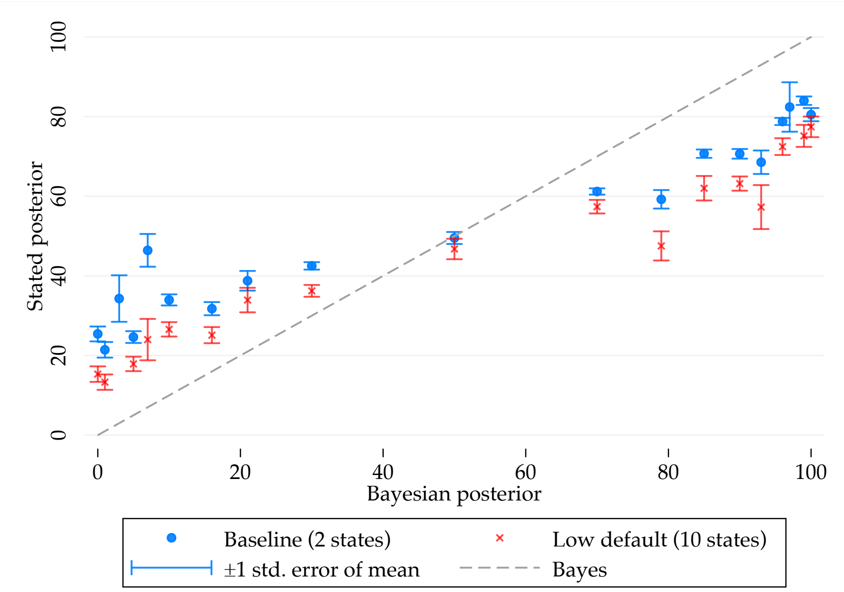


Figure 40: Stated average posteriors as a function of Bayesian posteriors, separately for treatments *Baseline Beliefs* and *Low Default Beliefs* (full sample). Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 5,668 beliefs of 1,000 subjects.

Table 17: Belief updating: Low versus high mental default (full sample)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
0 if *Baseline*, 1 if *Low Default*	-6.94***	-7.22***	-7.67***	-0.41***	-0.43***	-0.46***
	(0.97)	(0.94)	(1.00)	(0.06)	(0.06)	(0.06)
Bayesian posterior	0.54***	0.66***	0.66***			
	(0.01)	(0.02)	(0.02)			
Bayesian posterior × Cognitive uncertainty		-0.47***	-0.47***			
		(0.04)	(0.04)			
Cognitive uncertainty		19.5***	19.4***		-0.12*	-0.12
		(2.46)	(2.49)		(0.07)	(0.07)
Log [Likelihood ratio]				0.31***	0.38***	0.38***
				(0.01)	(0.02)	(0.02)
Log [Prior odds]				0.41***	0.56***	0.56***
				(0.02)	(0.03)	(0.03)
Log [Likelihood ratio] × Cognitive uncertainty					-0.29***	-0.29***
					(0.04)	(0.04)
Log [Prior odds] × Cognitive uncertainty					-0.56***	-0.56***
					(0.07)	(0.07)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	5668	5668	5668	5473	5473	5473
R^2	0.44	0.46	0.46	0.42	0.45	0.45

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.4 Results excluding Speeders

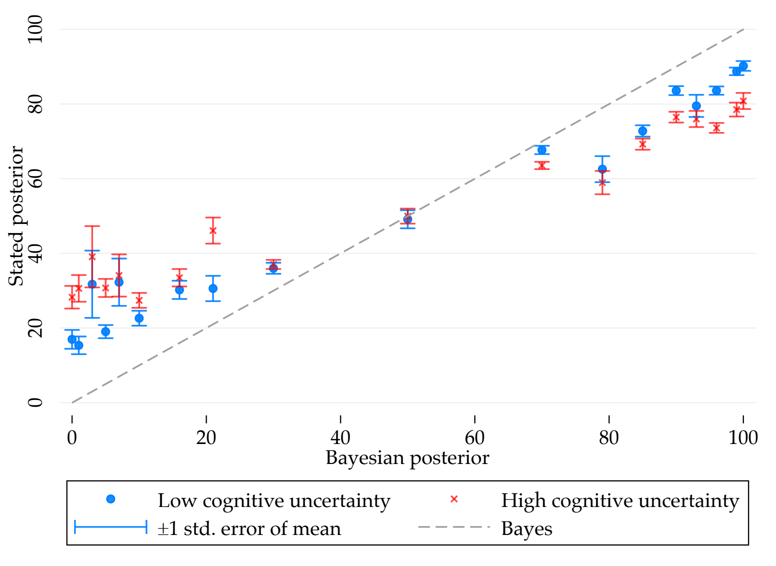


Figure 41: Relationship between average stated and Bayesian posteriors, separately for subjects above / below average cognitive uncertainty (excl. speeders). The partition is done separately for each Bayesian posterior. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 3,006 beliefs of 635 subjects.

Table 18: Belief updating: Baseline tasks (excl. speeders)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
Bayesian posterior	0.63***	0.78***	0.78***			
	(0.01)	(0.02)	(0.02)			
Bayesian posterior × Cognitive uncertainty		-0.57***	-0.57***			
		(0.05)	(0.05)			
Cognitive uncertainty		27.1***	27.3***		-0.066	-0.066
		(3.20)	(3.21)		(0.09)	(0.09)
Log [Likelihood ratio]				0.36***	0.42***	0.42***
				(0.01)	(0.02)	(0.02)
Log [Prior odds]				0.38***	0.53***	0.52***
				(0.02)	(0.04)	(0.04)
Log [Likelihood ratio] × Cognitive uncertainty					-0.29***	-0.29***
					(0.05)	(0.05)
Log [Prior odds] × Cognitive uncertainty					-0.55***	-0.55***
					(0.08)	(0.08)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	3006	3006	3006	2925	2925	2925
R^2	0.59	0.62	0.62	0.49	0.51	0.51

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

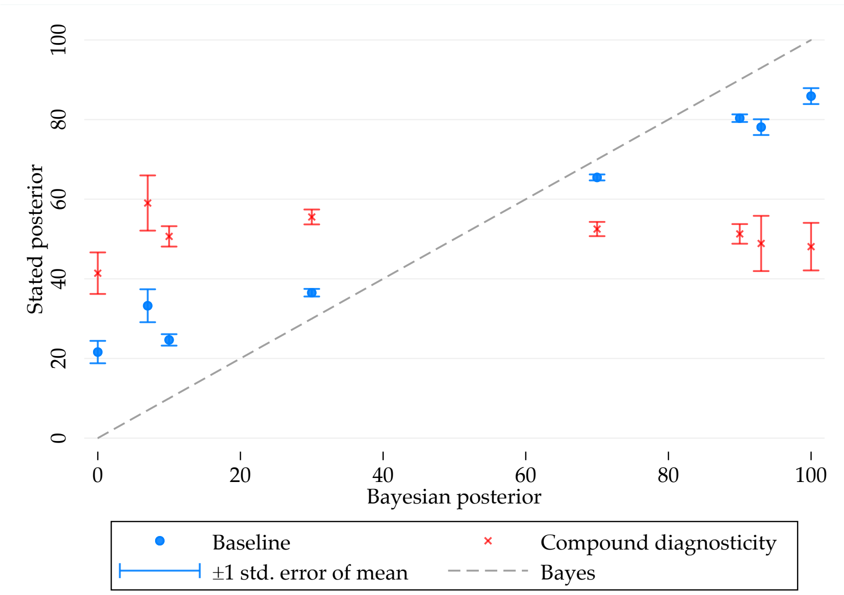


Figure 42: Stated average posteriors as a function of Bayesian posteriors, separately for reduced and compound belief updating problems (excl. speeders). The plot shows averages and corresponding standard error bars. To allow for a valid comparison between baseline and compound updating problems, the sample is restricted to updating tasks in which the base rate is 50:50. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 1,874 beliefs of 632 subjects.

Table 19: Belief updating: Reduced versus compound signal diagnosticities (excl. speeders)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
Bayesian posterior	0.45***	0.68***	0.68***			
	(0.02)	(0.02)	(0.02)			
Bayesian posterior × 1 if compound problem		-0.68***	-0.68***			
		(0.04)	(0.04)			
1 if compound problem		33.9***	34.1***		-0.071	-0.069
		(2.25)	(2.24)		(0.06)	(0.06)
Log [Likelihood ratio]				0.31***	0.41***	0.41***
				(0.02)	(0.02)	(0.02)
Log [Likelihood ratio] × 1 if compound problem					-0.31***	-0.31***
					(0.03)	(0.03)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	1874	1874	1874	1779	1779	1779
R^2	0.30	0.46	0.46	0.34	0.40	0.41

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

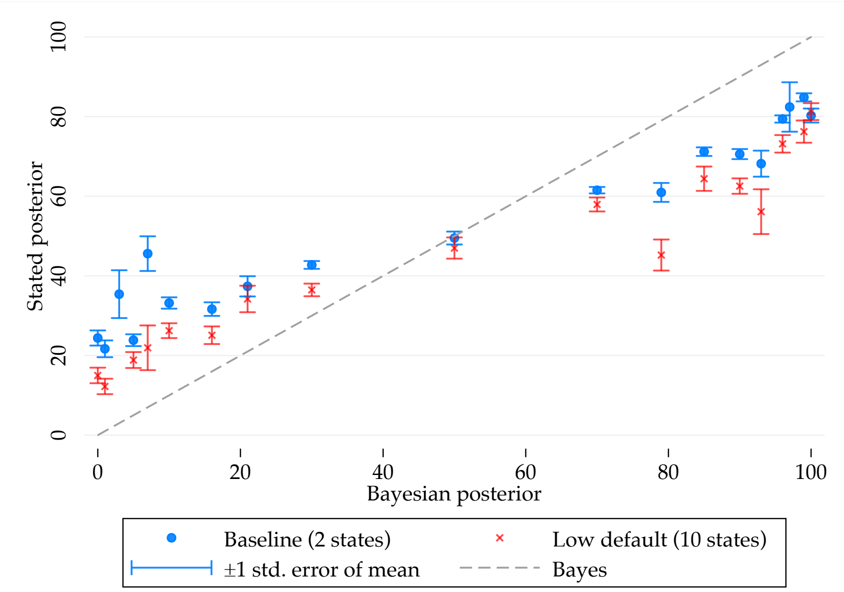


Figure 43: Stated average posteriors as a function of Bayesian posteriors, separately for treatments *Baseline Beliefs* and *Low Default Beliefs* (full sample). Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure is based on 5,107 beliefs of 899 subjects.

Table 20: Belief updating: Low versus high mental default (excl. speeders)

	Dependent variable:					
	Posterior belief			Log [Posterior odds]		
	(1)	(2)	(3)	(4)	(5)	(6)
0 if *Baseline*, 1 if *Low Default*	-6.64***	-6.88***	-7.16***	-0.40***	-0.42***	-0.43***
	(0.98)	(0.96)	(1.02)	(0.06)	(0.06)	(0.06)
Bayesian posterior	0.55***	0.67***	0.67***			
	(0.01)	(0.02)	(0.02)			
Bayesian posterior × Cognitive uncertainty		-0.48***	-0.48***			
		(0.04)	(0.04)			
Cognitive uncertainty		21.0***	20.9***		-0.065	-0.057
		(2.56)	(2.59)		(0.07)	(0.08)
Log [Likelihood ratio]				0.32***	0.38***	0.38***
				(0.01)	(0.02)	(0.02)
Log [Prior odds]				0.43***	0.58***	0.58***
				(0.02)	(0.03)	(0.03)
Log [Likelihood ratio] × Cognitive uncertainty					-0.28***	-0.28***
					(0.04)	(0.04)
Log [Prior odds] × Cognitive uncertainty					-0.57***	-0.57***
					(0.07)	(0.07)
Session FE	No	No	Yes	No	No	Yes
Demographic controls	No	No	Yes	No	No	Yes
Observations	5107	5107	5107	4930	4930	4930
R^2	0.45	0.47	0.48	0.44	0.46	0.46

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D Additional Details and Analyses for Survey Expectations

D.1 Additional Figures

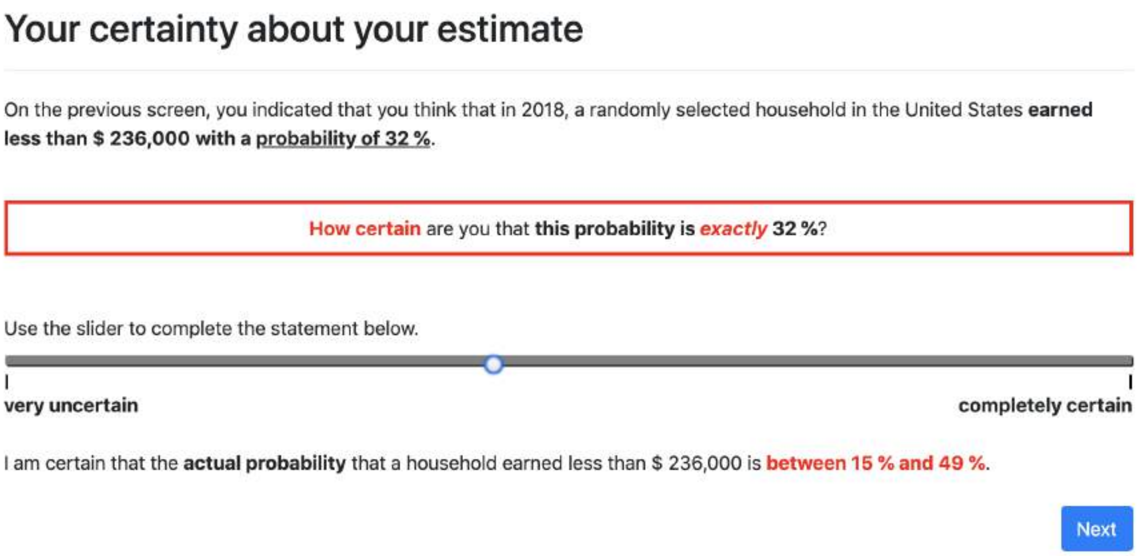


Figure 44: Decision screen to elicit cognitive uncertainty in survey expectations

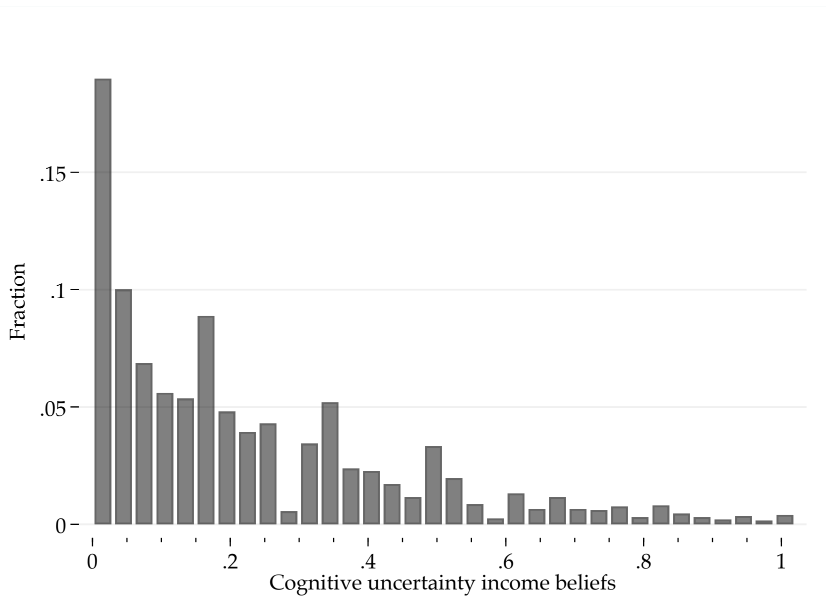


Figure 45: Histogram of cognitive uncertainty in survey expectations about income distribution

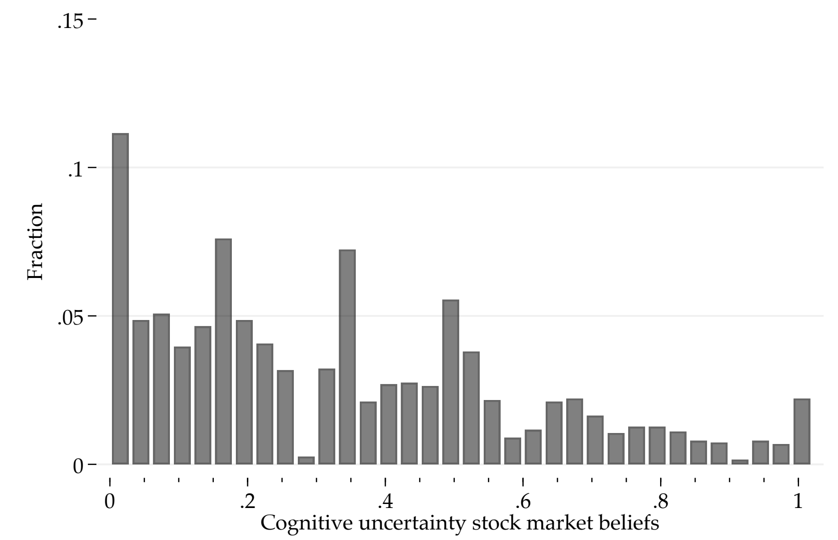


Figure 46: Histogram of cognitive uncertainty in survey expectations about the stock market

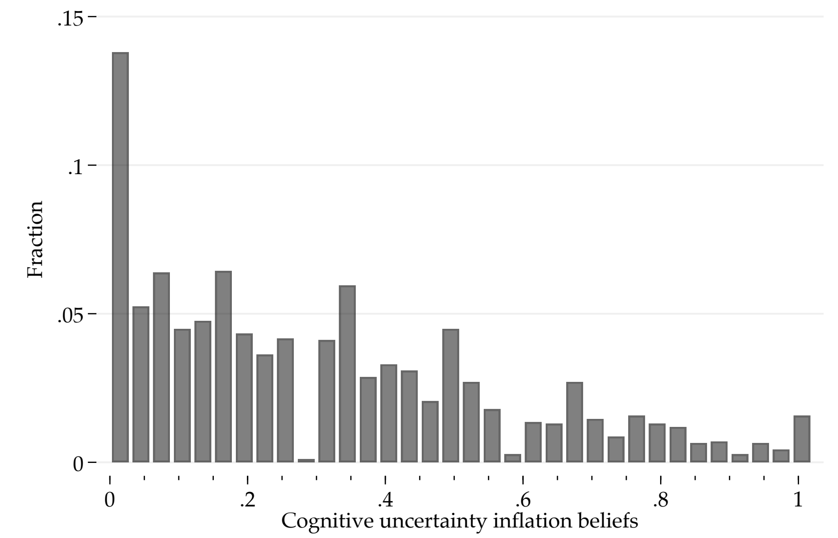


Figure 47: Histogram of cognitive uncertainty in survey expectations about inflation rates

D.2 Additional Tables

Table 21: Survey expectations and cognitive uncertainty

	Dependent variable: Probability estimate about:					
	Income distr.		Stock market		Inflation rate	
	(1)	(2)	(3)	(4)	(5)	(6)
Objective probability	0.92***	0.93***	0.74***	0.74***	0.80***	0.80***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Objective probability × Cognitive uncertainty	-0.60***	-0.60***	-0.70***	-0.70***	-0.81***	-0.80***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Cognitive uncertainty	29.4***	29.0***	34.2***	34.6***	39.1***	38.5***
	(2.44)	(2.50)	(2.09)	(2.13)	(2.67)	(2.74)
Session FE	No	Yes	No	Yes	No	Yes
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	1980	1980	1892	1892	1848	1848
R^2	0.84	0.84	0.54	0.55	0.56	0.56

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. In columns (1)–(2), the question about income distribution asks participants for the probability that a randomly selected U.S. household earns less than $x. In columns (3)–(4), the question about the stock market asks participants for the probability that in a randomly selected year the S&P500 increased by less than x%. In columns (5)–(6), the question about inflation rates asks participants for the probability that in a randomly selected year the inflation rate was less than x%. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 22: Estimates of "survey expectations weighting function"

Task / group	Sensitivity $\hat{\lambda}$	Elevation $\hat{\delta}$
Income distribution: high CU	0.51 (0.02)	1.08 (0.04)
Income distribution: low CU	0.75 (0.02)	1.27 (0.04)
Stock market performance: high CU	0.19 (0.01)	0.82 (0.03)
Stock market performance: low CU	0.45 (0.02)	0.84 (0.04)
Inflation rates: high CU	0.22 (0.01)	0.97 (0.03)
Inflation rates: low CU	0.47 (0.02)	0.98 (0.05)

Notes. Estimates of equation (15) for survey expectations, standard errors (clustered at subject level) reported in parentheses. CU = cognitive uncertainty (split at average).

D.3 Results with Full Sample

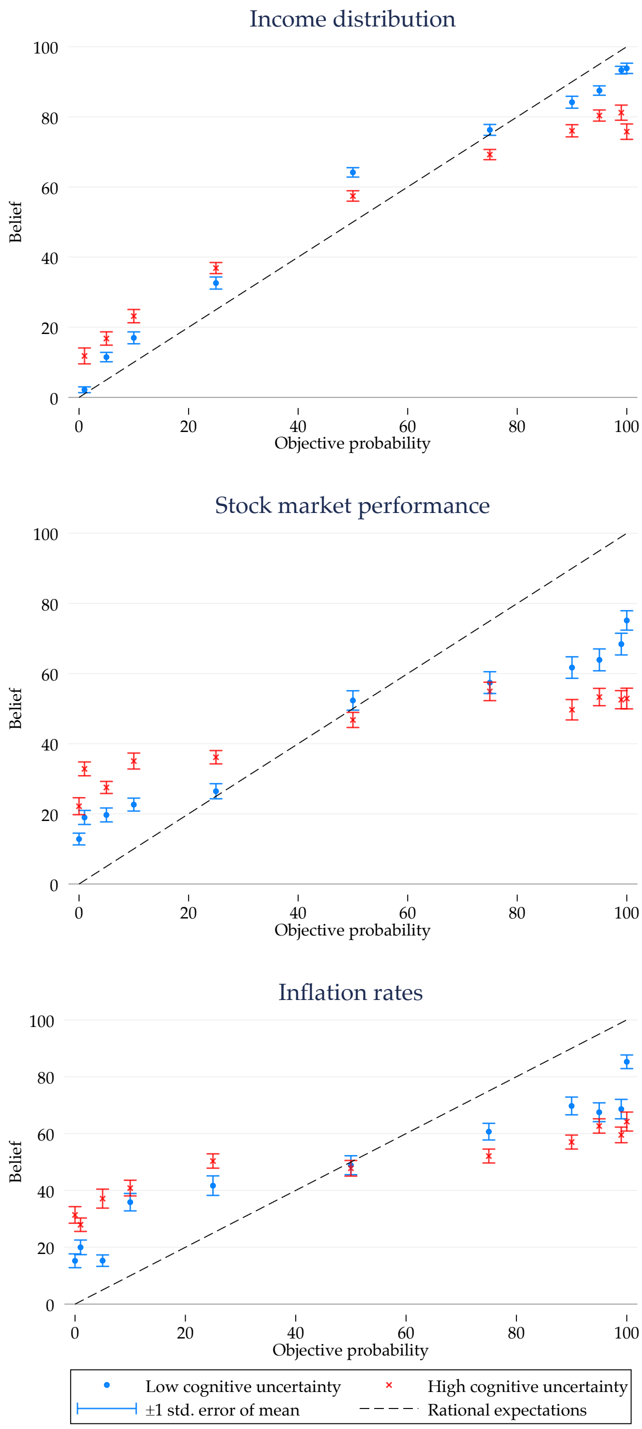


Figure 48: Survey beliefs as a function of objective probabilities, separately for subjects above / below average cognitive uncertainty (full sample). The partition is done separately for each probability bucket. In the top panel, the question asks for the probability that a randomly selected U.S. household earns less than \$x. In the middle panel, the question asks for the probability that in a randomly selected year the S&P500 increased by less than x%. In the bottom panel, the question asks for the probability that in a randomly selected year the inflation rate was less than x%. $N = 2,000$ observations each.

D.4 Results excluding Speeders

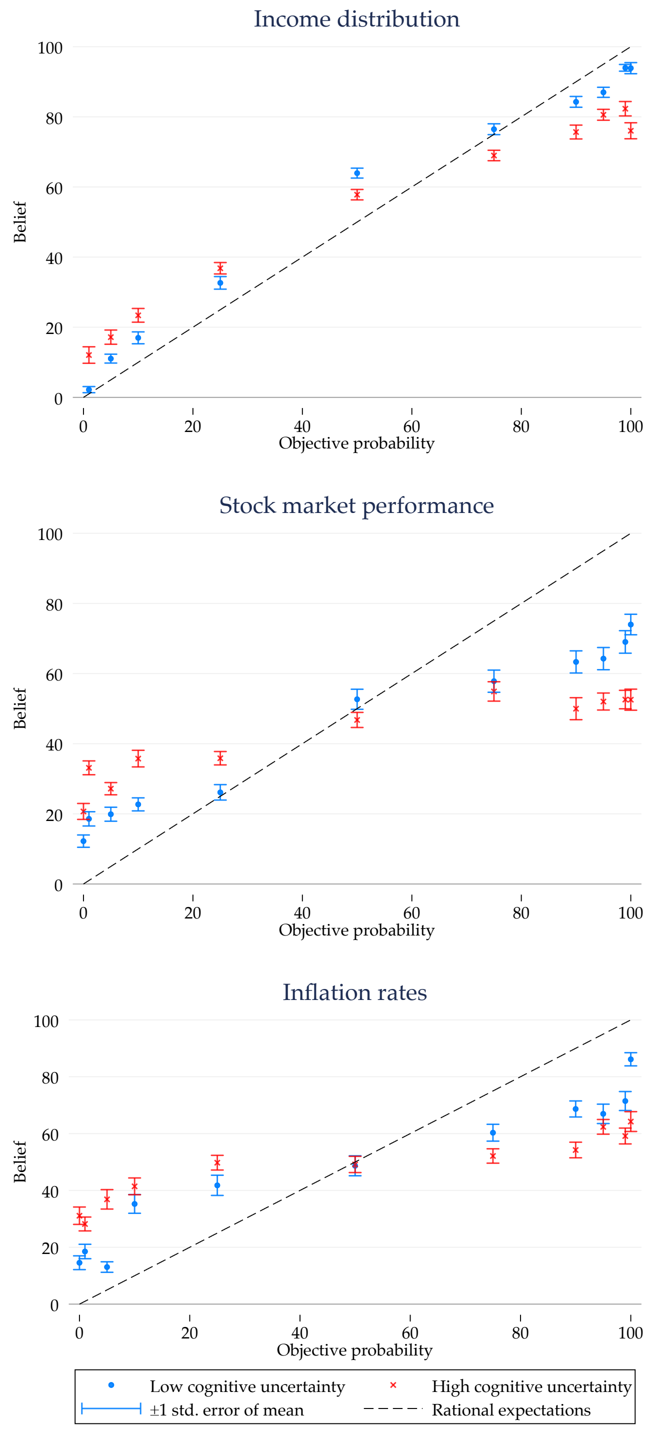


Figure 49: Survey beliefs as a function of objective probabilities, separately for subjects above / below average cognitive uncertainty (excl. speeders). The partition is done separately for each probability bucket. In the top panel, the question asks for the probability that a randomly selected U.S. household earns less than \$x. In the middle panel, the question asks for the probability that in a randomly selected year the S&P500 increased by less than x%. In the bottom panel, the question asks for the probability that in a randomly selected year the inflation rate was less than x%. $N = 1,896$ observations each.

E Forward-Looking Survey Expectations

In Section 5 in the main text, we elicited respondents' survey expectations about economic variables with respect to past values, which allowed us to easily incentivize participants. In a pre-registered robustness check, we implemented the same type of survey questions, but now regarding future values of these variables. These questions are hence theoretically more appropriate in that they elicit actual expectations, but they are not financially incentivized. The sample size is $N = 400$ for each of the three domains. We apply the same criteria regarding the exclusions of outliers as in Section 5.

The results are shown in Figure 50. Here, we define "objective probabilities" based on historical data, akin to Figure 10 in the main text. The results are almost identical to those reported in the main text.

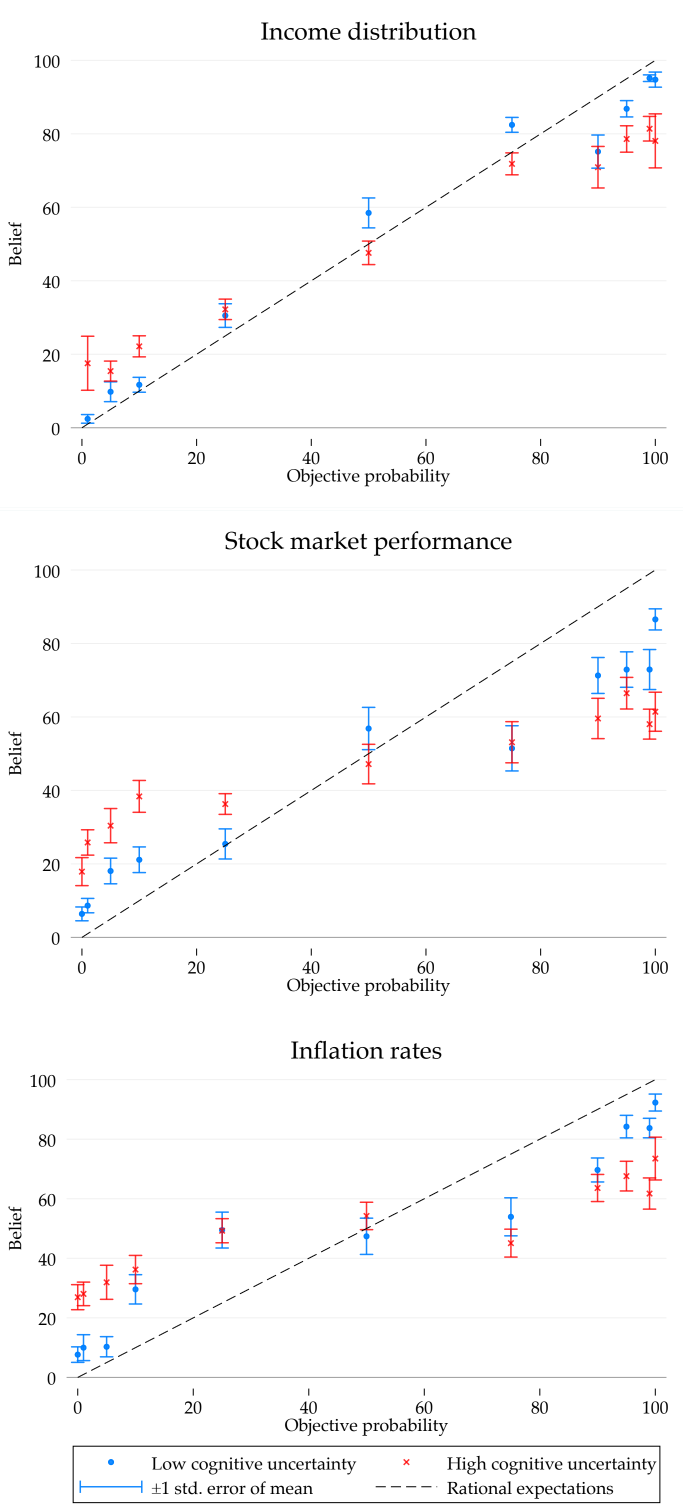


Figure 50: Survey beliefs about future variables as a function of "objective" probabilities, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each probability bucket. "Objective" probabilities are defined using historical data, analogously to Figure 10. In the top panel, the question asks for the probability that a randomly selected U.S. household will earn less than \$x ($N = 491$). In the middle panel, the question asks for the probability that the S&P500 will increase by less than x% ($N = 463$) over the course of one year. In the bottom panel, the question asks for the probability that the inflation rate will be than x% ($N = 478$).

F Additional Ambiguity Experiment

In addition to the experiments reported in Section 3, we implemented an additional set of pre-registered ambiguity experiments. These experiments delivered statistically significant results in line with our pre-registered predictions. However, as explained below, we now believe that these experiments are conceptually less-than-ideal from the perspective of our framework, which is why we relegate them to an Appendix.

F.1 Experimental Design

The basic design builds on Dimmock et al. (2015) and aims at eliciting matching probabilities for ambiguous lotteries. In a given choice list, the left-hand side option A was constant and given by an ambiguous lottery. The ambiguous lottery was described as random draw from an urn that comprises 100 balls of ten different colors, where the precise composition of colors is unknown. A known number of these colors n were "winning colors" that resulted in the same payout $x, while other colors resulted in a zero payout. Option B, on the right-hand side, varied across rows in the choice list and was also given by a lottery with upside $x. Here, the number of "winning balls" was known and varied from 0% to 99% in 3% steps. Subjects were always given the option to pick their preferred winning colors.

A subject completed six choice lists, where the payout $x \in \{15, 20, 25\}$ and the number of winning colors $n \in \{1, 2, \ldots, 9\}$ were randomly determined. Before each decision screen, subjects were always given the opportunity to pick their winning colors.

Cognitive uncertainty was measured analogously to choice under risk. After subjects had indicated their probability equivalent range for an ambiguous lottery, the subsequent screen asked them how certain they are that this range actually corresponds to how much the lottery is worth to them. Operationally, subjects used a slider to calibrate the statement "I am certain that to me the lottery is worth as much as playing a lottery over $x with a known number of between x and y winning balls." 200 AMT workers participated in these experiments and earned an average of $7.20.

F.2 Results

In the baseline analysis, we again exclude extreme outliers, defined as matching probability strictly larger than 75% for at most two winning colors, and matching probability strictly smaller than 25% for more than eight winning colors. This is the case for 1.6% of our data. We find that the response function of subjects with higher cognitive uncertainty is significantly less sensitive to variation in the number of winning colors (shallower), see the regressions in Table 23. This reduction in sensitivity corresponds to our

Table 23: Insensitivity to ambiguous "likelihood" and cognitive uncertainty

	Dependent variable: Matching probability	
	(1)	(2)
Number of winning colors * 10	0.68***	0.67***
	(0.04)	(0.04)
Number of winning colors * 10 × Cognitive uncertainty	-0.26***	-0.25**
	(0.10)	(0.10)
Cognitive uncertainty	5.90	3.87
	(5.14)	(5.14)
Session FE	No	Yes
Demographic controls	No	Yes
Observations	1181	1181
R^2	0.50	0.51

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. The dependent variable is a subject's matching probability, computed as midpoint of the switching interval. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

main hypothesis, which is also what we re-registered. At the same time, we do not find that high cognitive uncertainty subjects are more ambiguity seeking than low cognitive uncertainty subjects for unlikely events.

F.3 Interpretive Problems

The analysis above focuses on whether reported matching probabilities of subjects with higher cognitive uncertainty are less sensitive to the variation in winning colors. However, our framework in Section 2 *only* makes this prediction if one assumes that the state space is binary (win-lose), so that subjects are hypothesized to "shrink" ambigious probabilities towards 50:50. However, in the experiments, the state space was represented through ten different colors, some of which are winning and some of which are losing colors. As discussed in Section 3.4, a plausible alternative view is that in this situation there are actually ten states of the world, one for each color. In this case, our framework does not predict that subjects shrink their matching probabilities towards 50:50. To see this, take the example that there are three winning colors. In this case, the ignorance prior (for winning) would be given by 30%. In other words, subjects would be hypothesized to shrink an ambiguous probability of three winning colors towards a mental default of 30%, which does not produce any shrinking theoretically. For this reason, we view these experiments as imperfect.

G Results on Stake Size Increase

G.1 Stake Size and Choice Under Risk

To manipulate the size of financial incentives, we implement a within-subjects manipulation. We implemented the same procedures as described in Section 3, except that we only implemented gain lotteries. Subjects completed six choice lists, one of which determined a subject's payment in case the choice under risk part of the experiment got selected for payment (probability 1/3). Across the six choice lists, the probability of being payout-relevant varied in a transparent way. On top of the decision screen, we informed subjects about the probability that this choice list would determine their payout. For five tasks, this probability was given by 1% and for one task by 95%. As a measure of cognitive effort, we recorded subjects' (log) response times. 150 subjects participated in this treatment, which was also pre-registered.

The results are reported in Table 24.[14] Exploiting variation within subjects across tasks, we find that response times increase significantly from 25 seconds on average to 36 seconds on average in the high stakes task. However, this increase in response times does not translate into a significant change in cognitive uncertainty.

Table 24: Effects of stake size increase in choice under risk

	Dependent variable:					
	Log [Response time]		Cognitive uncertainty		Normalized CE	
	(1)	(2)	(3)	(4)	(5)	(6)
1 if high stakes	0.26***	0.26***	-0.0041	-0.0037	0.41	-1.65
	(0.06)	(0.06)	(0.01)	(0.01)	(2.27)	(2.16)
Probability of payout					0.69***	0.68***
					(0.03)	(0.03)
Probability of payout × 1 if high stakes					0.022	0.065*
					(0.04)	(0.04)
Subject FE	No	Yes	No	Yes	No	Yes
Observations	893	893	893	893	893	893
R^2	0.02	0.50	0.00	0.53	0.60	0.79

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[14]We again apply the same outlier exclusion criteria as in the main text.

G.2 Stake Size and Belief Updating

To manipulate the size of financial incentives, we again implement a within-subjects manipulation. We implemented the same procedures as described in Section 4, except that we did not elicit the WTP for the optimal guess. Subjects completed six updating tasks, one of which determined a subject's payment in case the belief updating part of the experiment got selected for payment (probability 1/3). Across the six tasks, the probability of being payout-relevant varied in a transparent way. On top of the decision screen, we informed subjects about the probability that this task would determine their payout. For five tasks, this probability was given by 1% and for one task by 95%. As a measure of cognitive effort, we recorded subjects' (log) response times. 150 subjects participated in this treatment, which was also pre-registered.

The results are reported in Table 25.[15] Exploiting variation within subjects across tasks, we find that response times increase significantly. Cognitive uncertainty decreases, but only mildly so.

Table 25: Effects of stake size increase in belief updating

	Dependent variable:					
	Log [Response time]		Cognitive uncertainty		Posterior belief	
	(1)	(2)	(3)	(4)	(5)	(6)
1 if high stakes	0.19***	0.19***	-0.024*	-0.025	-2.76	-3.56
	(0.06)	(0.07)	(0.01)	(0.02)	(2.53)	(2.64)
Bayesian posterior					0.59***	0.58***
					(0.03)	(0.03)
Bayesian posterior × 1 if high stakes					0.065	0.080*
					(0.04)	(0.04)
Subject FE	No	Yes	No	Yes	No	Yes
Observations	869	869	869	869	869	869
R^2	0.01	0.46	0.00	0.51	0.61	0.70

Notes. OLS estimates, robust standard errors (in parentheses) are clustered at the subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[15] We again apply the same outlier exclusion criteria as in the main text.

H Calibrating the Cognitive Uncertainty Measurement

In all of our experiments, the elicitation of cognitive uncertainty did not specify which particular version of a subjective confidence interval we intend to elicit, such as a 90%, 95%, 99% or 100% confidence interval. We deliberately designed our experiments in this fashion because the hypothesis that underlines our research is that people have a hard time translating "99% confidence" into a statement about e.g. their certainty equivalent. In an attempt to trade off subject comprehension and quantitative interpretation, we hence refrained from inducing a particular version of a confidence interval.

To provide evidence for our conjecture that respondents cannot really tell the difference between different types of confidence intervals, we implemented an additional set of choice under risk experiments in which we elicited different versions of subjective confidence intervals. In these experiments, subjects were specifically instructed to state an interval such that they are "y% certain" that to them the lottery is worth between a and b. Across experimental conditions, y varied from 75% to 90% to 95% to 99% to 100%. To analyze these data, we compare average cognitive uncertainty within a treatment with average cognitive uncertainty in our baseline treatments, in which we did not provide a specific quantitative version of a confidence interval. In total, we ran these experiments with $N = 293$ subjects.

Figure 51 summarizes the results. Here, we plot the coefficients of the different treatment dummies in a regression with stated cognitive uncertainty as dependent variable. In this regression, the omitted category is our (unspecific) baseline treatment. Each coefficient hence corresponds to the implied difference in cognitive uncertainty between a treatment and our baseline treatment. There are two main results. First, cognitive uncertainty does not vary in meaningful ways across conditions: subjects state statistically indistinguishable cognitive uncertainty intervals, regardless of whether we specify them as 75%, 90% etc. interval. Second, if anything, reported cognitive uncertainty is *higher* in the more precise quantitative versions relative to our baseline version, as can be inferred from the positive point estimates. This again suggests that subjects have a harder time thinking about specific quantitative versions of a confidence interval relative to our more intuitive question. We conclude from this exercise that a more precise quantitative implementation of our cognitive uncertainty interval is unlikely to deliver a more helpful quantitative interpretation of our measure.

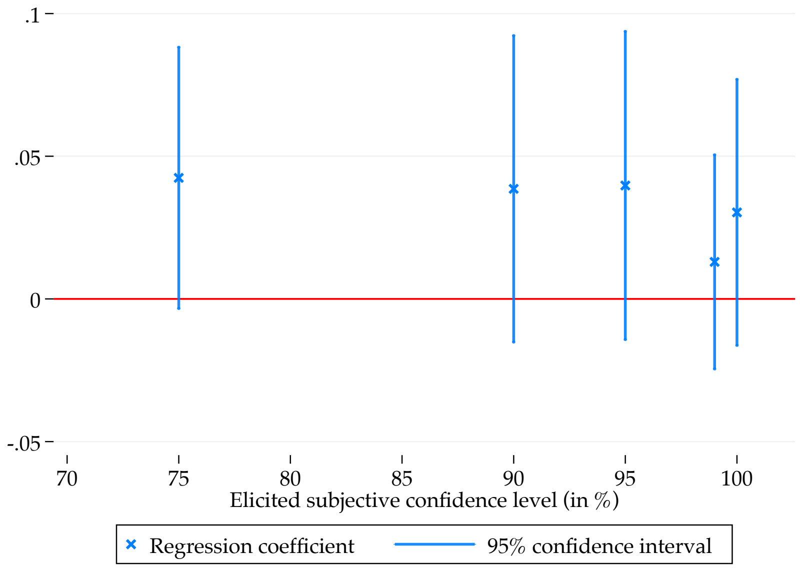


Figure 51: Comparison of average cognitive uncertainty across different elicitation modes in choice under risk. Each dot represents the coefficient of a treatment dummy in a regression with cognitive uncertainty as dependent variable. The explanatory variables are fixed effects for the different specifications of cognitive uncertainty, where the omitted category is our baseline wording. The plot controls for lottery amount fixed effects and probability of payout fixed effects.

I Censoring

In this section we replicate our weighting functions for subjects above and below average cognitive uncertainty after excluding observations that are affected by the boundaries of the response scales. Specifically, in the figures reported in section I.1 we exclude all observations in which the choices or beliefs exactly equaled one of boundaries of the response scale, whereas in section I.2 we exclude all observations in which the cognitive uncertainty range included one of the boundaries. The observed differences between high and low cognitive uncertainty choices or beliefs remain virtually unaffected by these exclusions.

I.1 Censored choices and beliefs

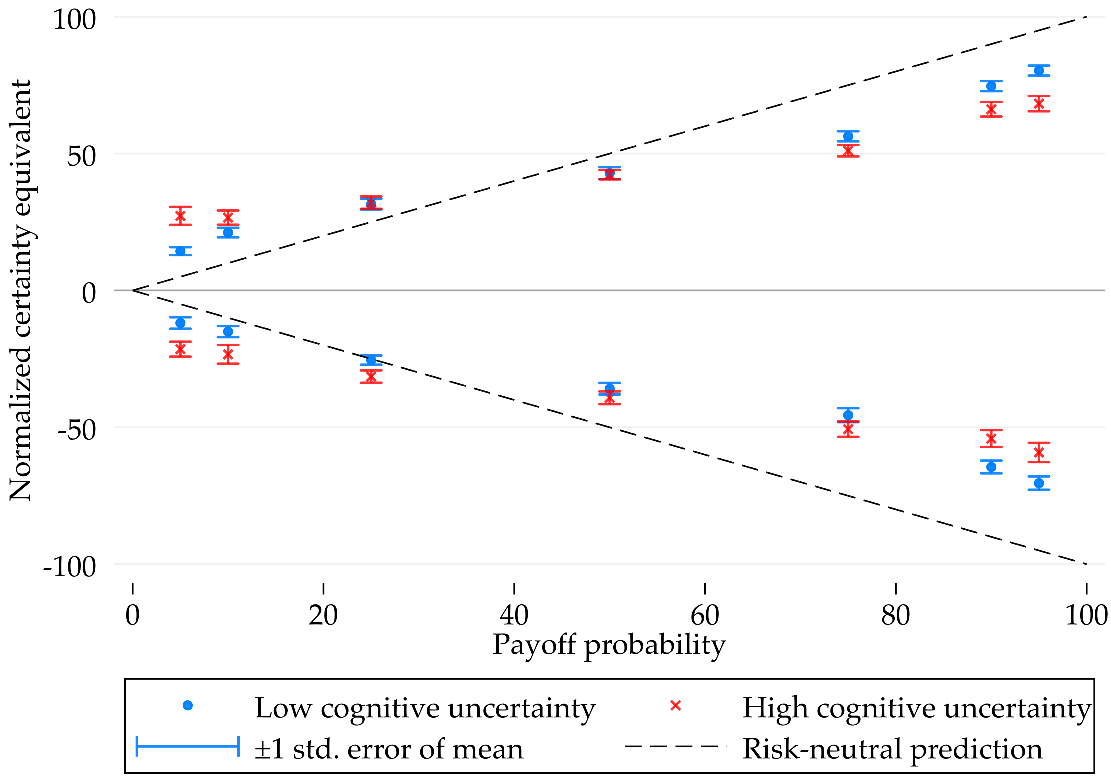


Figure 52: Probability weighting function excluding censored choices, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each probability × gains / losses bucket. The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure excludes 4.28% of the original data that is based on 2,525 certainty equivalents of 700 subjects.

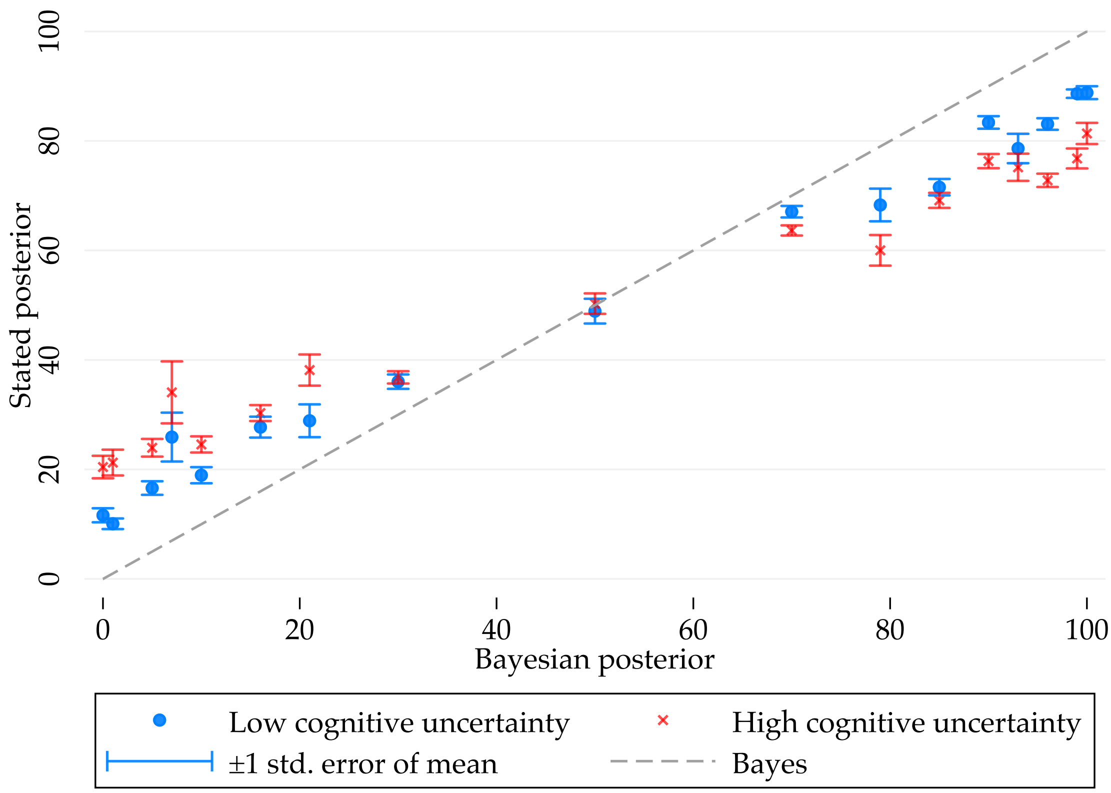


Figure 53: Relationship between average stated and Bayesian posteriors after excluding censored beliefs, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each Bayesian posterior. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure excludes 2.6% of the original data that is based on 3,187 beliefs of 700 subjects.

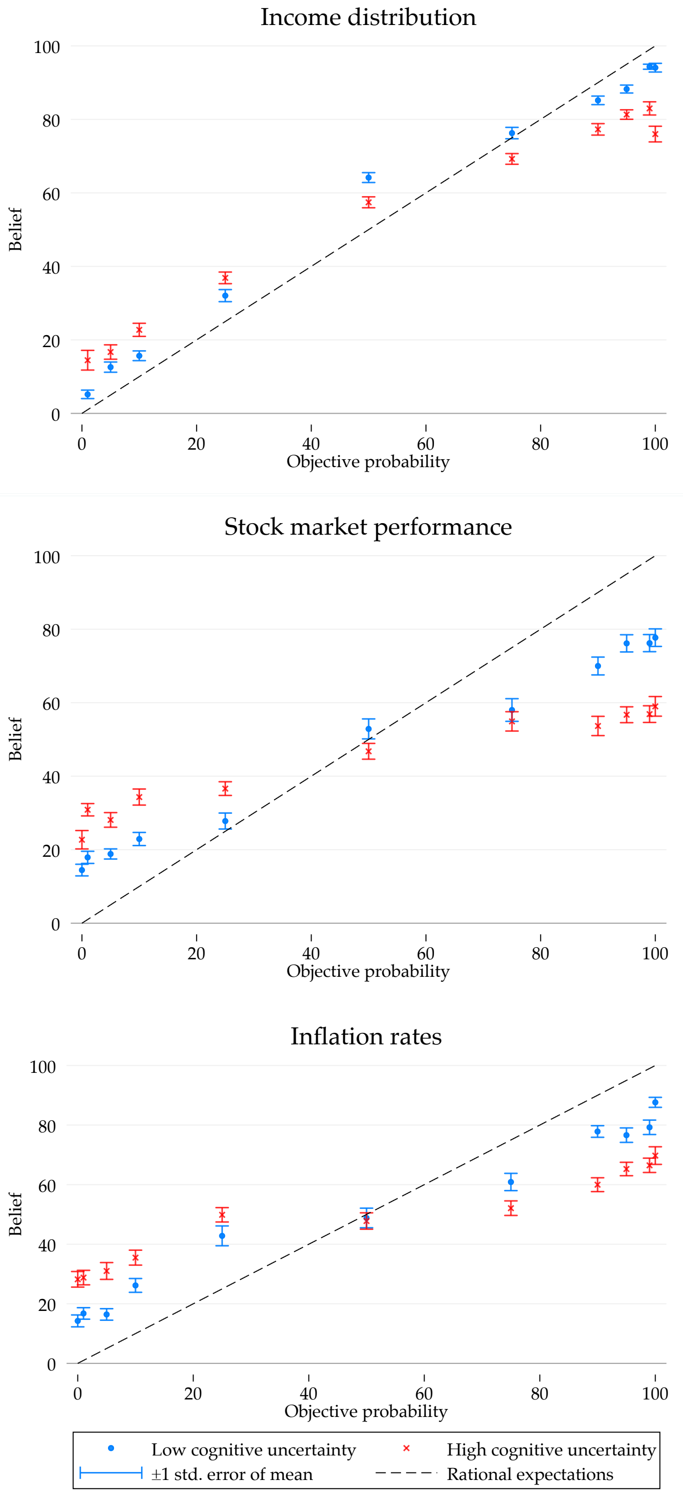


Figure 54: Survey beliefs as a function of objective probabilities after excluding censored beliefs, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each probability bucket. In the top panel, the question asks for the probability that a randomly selected U.S. household earns less than $x. In the middle panel, the question asks for the probability that in a randomly selected year the S&P500 increased by less than x%. In the bottom panel, the question asks for the probability that in a randomly selected year the inflation rate was less than x%. The figure excludes 6.61% of the original data that is based on 5,703 observations.

I.2 Censored cognitive uncertainty ranges

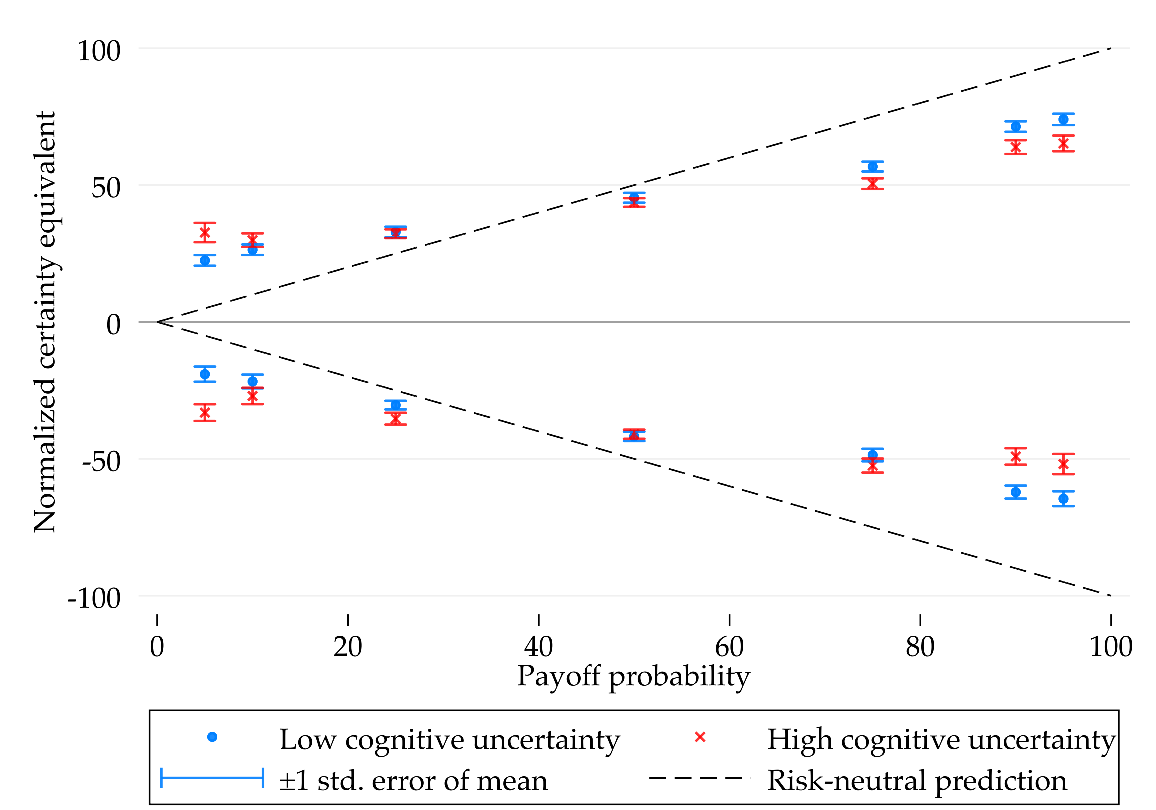


Figure 55: Probability weighting function excluding censored cognitive uncertainty ranges, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each probability × gains / losses bucket. The plot shows averages and corresponding standard error bars. Normalized certainty equivalents (implied probability weights) are computed as certainty equivalent divided by payout probability. The figure excludes 23.25% of the original data that is based on 2,525 certainty equivalents from 700 subjects.

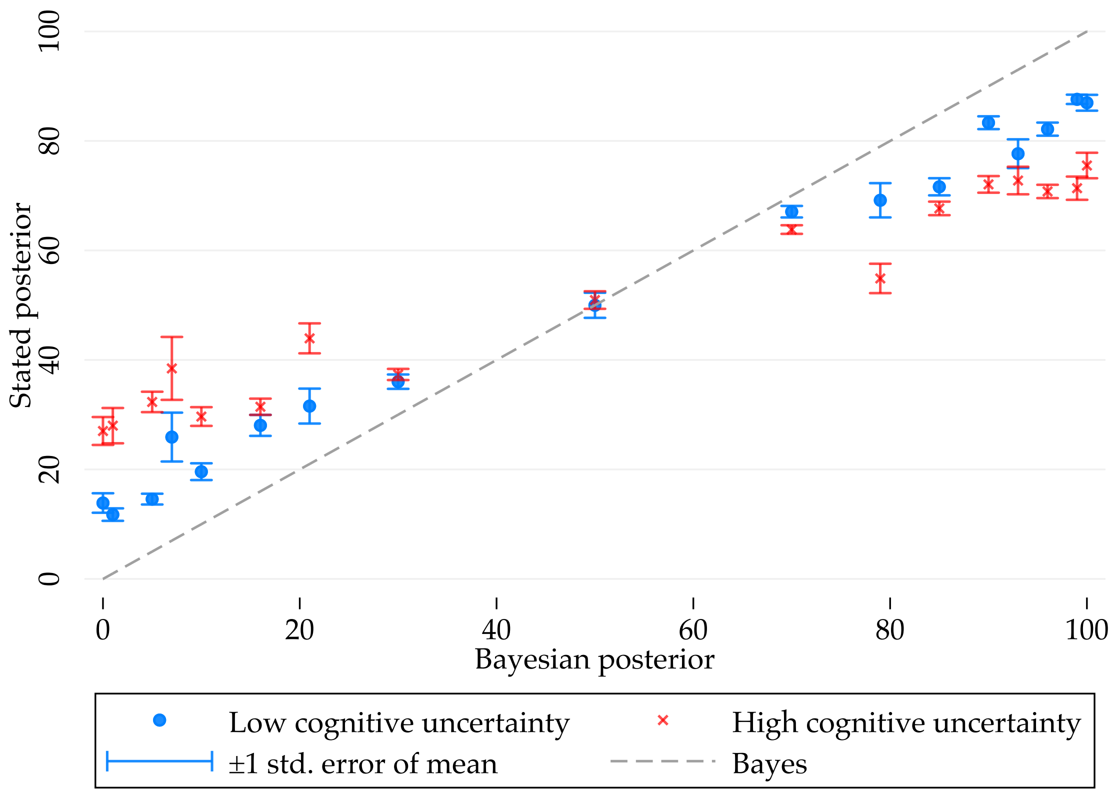


Figure 56: Relationship between average stated and Bayesian posteriors after excluding censored cognitive uncertainty ranges, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each Bayesian posterior. Bayesian posteriors are rounded to the nearest integer. We only show buckets with more than ten observations. The figure excludes 25.93% of the original data that is based on 3,187 beliefs of 700 subjects.

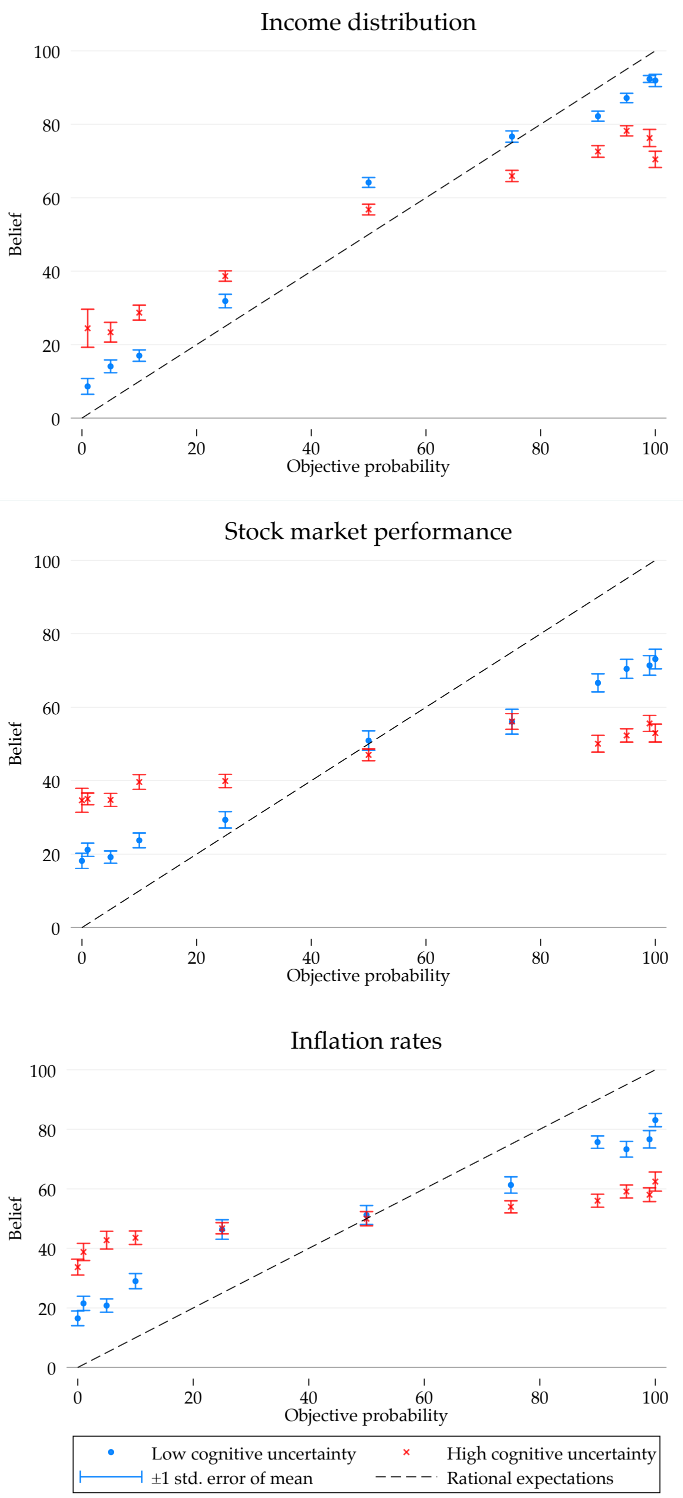


Figure 57: Survey beliefs as a function of objective probabilities after excluding censored cognitive uncertainty ranges, separately for subjects above / below average cognitive uncertainty. The partition is done separately for each probability bucket. In the top panel, the question asks for the probability that a randomly selected U.S. household earns less than $x. In the middle panel, the question asks for the probability that in a randomly selected year the S&P500 increased by less than x%. In the bottom panel, the question asks for the probability that in a randomly selected year the inflation rate was less than x%. The figure excludes 16.66% of the original data that is based on 5,703 observations.

J Experimental Instructions and Control Questions

J.1 Treatment *Baseline Risk*

Welcome

Thank you for participating in this study.

This study will take approximately 25 minutes to complete.

You will earn a fixed reward of $0.50. In addition, you can earn a bonus for completing the study. To complete the study, you will need to read all instructions carefully and answer the corresponding comprehension questions correctly. You receive a minimum bonus of $1.20 when you complete the study.

You can earn an ***additional*** **bonus**. At the end of the study, one of the tasks will be randomly selected and your decision in this task determines your additional bonus. The chance that you get paid an additional bonus for the first part is 1 in 3.

Important information

- You should think about each task **independently** of all other tasks in this study. There is no point in strategizing across tasks.
- You will note that we sometimes ask you to work on similar-sounding tasks. Theses tasks might have similar answers, or very different ones. Please consider each individual task **carefully**.

Next

Part 1: Instructions

Please read these instructions carefully. There will be comprehension checks. If you fail these, you will be excluded from the study and only receive the reward of $0.50.

In this study, there are various lotteries, all of which pay different amounts of money with different probabilities. An example lottery is:

With probability **70%: Get $ 20**
With probability **30%: Get $ 5**

This means that the lottery pays **either** $20 **or** $5 (with different probabilities), but a lottery always only pays out one of the dollar amounts. The lotteries will actually be played out by the computer and determine your earnings in exactly the way we describe on the following pages.

In total, we have created 6 lotteries. For each lottery, you will make decisions on two consecutive decision screens.

- Decision screen 1: You will make various choices to indicate **how much** a lottery is worth to you.
- Decision screen 2: You will indicate **how certain** you are about how much **exactly** a lottery is worth to you.

Throughout the experiment, there are no right or wrong answers, because how much you like a lottery depends on your personal taste. We are only interested in learning about what you prefer.

Decision screen 1

On decision screen 1, you will be asked to choose which of two payment options you prefer. You will see choice lists such as the one below, where each row is a separate choice. In every list, the left-hand side option (Option A) is one of the lotteries that we generated, which is identical in all rows. The right-hand side option (Option B) is a safe payment that you would receive *with certainty*, so there is no risk attached. This safe payment in Option B increases as you go down the list.

You should consider the choice in each row **independently** of all other rows, because in the end one row will be randomly selected for payout and you will receive the option that you selected in that row. In some choice lists that you complete, you will receive a budget. If so, this budget will be listed at the top of your screen and paid out to you along with the payouts from the lottery.

Usually, people start by preferring Option A for small certain amounts (at the top of the list). At some point they switch to Option B as they proceed down the list, because the certain amount associated with Option B increases, so that Option B becomes more attractive. **Thus, an effective way to complete these choice lists is to determine in which row you would like to switch from Option A to Option B.**

Based on your decisions in this choice list, we assess **how much the lottery is worth to you by using those certain payments where you switch from Option A to Option B.** For example, in the example choice list below, the lottery would be worth between $13 and $14 to you, because this is where switching occurs.

Option A			Option B
With probability **70%**: Get **$ 20** With probability **30%**: Get **$ 5**	●	○	With certainty: Get **$ 0**
	●	○	With certainty: Get **$ 1**
	●	○	With certainty: Get **$ 2**
	●	○	With certainty: Get **$ 3**
	●	○	With certainty: Get **$ 4**
	●	○	With certainty: Get **$ 5**
	●	○	With certainty: Get **$ 6**
	●	○	With certainty: Get **$ 7**
	●	○	With certainty: Get **$ 8**
	●	○	With certainty: Get **$ 9**
	●	○	With certainty: Get **$ 10**
	●	○	With certainty: Get **$ 11**
	●	○	With certainty: Get **$ 12**
	●	○	With certainty: Get **$ 13**
	○	●	With certainty: Get **$ 14**
	○	●	With certainty: Get **$ 15**
	○	●	With certainty: Get **$ 16**
	○	●	With certainty: Get **$ 17**
	○	●	With certainty: Get **$ 18**
	○	●	With certainty: Get **$ 19**
	○	●	With certainty: Get **$ 20**

Click "Next" to read about decision screen 2.

Next

Decision screen 2 (for the same lottery)

For any given lottery, you may actually be **uncertain about how much money it is really worth** to you. For some lotteries, you may know exactly how much they are worth to you. For other lotteries, you may feel uncertain about whether a lottery is worth, say, $12, $13, $14, $15, or $16 to you.

On the second decision screen for a given lottery, we will hence ask you to use a slider to indicate **how certain** you are that your decisions on the first decision screen correspond **exactly** to how much the lottery is **worth to you**.

- The slider is linked to the statement below the slider. As you move around the slider, the values in this statement change. Your task is to position the slider in such a way that the statement corresponds to how you feel about the lottery.
- The **further you move the slider to the right, the more certain** you are about how much exactly the lottery is worth to you.
- For every step that you move the slider **further to the left (the less certain you are),** the range of dollar values that you consider possible increases by $0.50.

Example

Suppose that on the first decision screen you indicated that the lottery below is worth between $13 and $14 to you (because you switched from Option A to B between $13 and $14). Your screen would then look like this:

Example lottery:

With probability **70%: Get $ 20**
With probability **30%: Get $ 5**

How certain are you that to you this lottery **is worth *exactly* the same as getting between $13 and $14** for sure?

very uncertain **completely certain**

I am certain that the lottery is worth **Use the slider!** to me.

Next

Your payment for part 1

If this part is randomly selected for payment in the end, your *additional* bonus will be determined as follows:

The computer will randomly select one choice list for payout, with equal probability. We then randomly select one of your decisions from this choice list (with equal probability), and this decision will be implemented for real payment.

Thus, you should take each decision independently of all other decisions as if it's the one that counts, because it may be.

Next

Comprehension questions

The questions below test your understanding of the instructions.

Important: If you fail to answer any one of these questions correctly, you will not be allowed to participate in the rest of the study, and you will not be able to earn a bonus.

1. Which one of the following statements is correct if the following lottery is played for you?

   With probability **60%: Get $ 15**
   With probability **40%: Get $ 5**

   Please select one of the statements:

   - It is possible that I get paid both $15 and $5, i.e., I may receive a total amount of $20 from this lottery.
   - I receive EITHER $15 OR $5 from this lottery.
   - It is possible that I receive no money from this lottery.

2. Suppose a person made the decisions shown in the picture below. Which of the following statements is correct regarding these decisions?

Option A	A	B	Option B
With probability **60%**: Get **$ 15**; With probability **40%**: Get **$ 5**	●	○	With certainty: Get **$ 0**
	●	○	With certainty: Get **$ 1**
	●	○	With certainty: Get **$ 2**
	●	○	With certainty: Get **$ 3**
	●	○	With certainty: Get **$ 4**
	●	○	With certainty: Get **$ 5**
	●	○	With certainty: Get **$ 6**
	●	○	With certainty: Get **$ 7**
	●	○	With certainty: Get **$ 8**
	○	●	With certainty: Get **$ 9**
	○	●	With certainty: Get **$ 10**
	○	●	With certainty: Get **$ 11**
	○	●	With certainty: Get **$ 12**
	○	●	With certainty: Get **$ 13**
	○	●	With certainty: Get **$ 14**
	○	●	With certainty: Get **$ 15**

   Please select one of the statements:

   - This person indicated that the lottery is worth more to them than $9.
   - This person indicated that the lottery is worth between $3 and $7 to them.
   - This person indicated that the lottery is worth between $8 and $9 to them.

3. Now imagine that the person who made the decisions above is uncertain about how much exactly the lottery is worth to them.
   This person is certain, however, that the lottery is worth between $6 and $11 to them. Please position the slider to accurately reflect this level of certainty:

   very uncertain — **completely certain**

   This person is certain that the lottery is worth **Use the slider!** to them.

Next

J.2 Treatment *Low Default Risk*

Welcome

Thank you for participating in this study.

This study will take approximately 25 minutes to complete.

You will earn a fixed reward of $0.50. In addition, you can earn a bonus for completing the study. To complete the study, you will need to read all instructions carefully and answer the corresponding comprehension questions correctly. You receive a **minimum bonus of $1.20** when you complete the study.

You can earn an ***additional* bonus**. At the end of the study, one of the tasks will be randomly selected and your decision in this task determines your additional bonus. The chance that you get paid an additional bonus for the first part is 1 in 3.

Important information

- You should think about each task **independently** of all other tasks in this study. There is no point in strategizing across tasks.
- You will note that we sometimes ask you to work on similar-sounding tasks. Theses tasks might have similar answers, or very different ones. Please consider each individual task **carefully**.

Next

Part 1: Instructions

Please read these instructions carefully. There will be comprehension checks. If you fail these, you will be excluded from the study and only receive the reward of $0.50.

In this study, there are various lotteries, all of which pay different amounts of money with different probabilities. To illustrate these probabilities, we will use the metaphor of colored balls in a bag. Imagine that there is a bag that contains 100 balls. Each of these balls has one of the following ten colors:

- red
- blue
- green
- orange
- brown
- pink
- black
- gold
- gray
- purple

The computer selects one of the 100 balls at random, where each ball is equally likely to get selected. Across lotteries, the number of balls of a given color might vary. Each color is associated with its own corresponding payout for you. An example lottery is:

70 out of 100 balls are **red**.
If a **red** ball is drawn: **Get $ 20**

3 out of 100 balls are **blue**.
If a **blue** ball is drawn: **Get $ 5**

3 out of 100 balls are **green**.
If a **green** ball is drawn: **Get $ 5**

3 out of 100 balls are **orange**.
If a **orange** ball is drawn: **Get $ 5**

3 out of 100 balls are **brown**.
If a **brown** ball is drawn: **Get $ 5**

3 out of 100 balls are **pink**.
If a **pink** ball is drawn: **Get $ 5**

3 out of 100 balls are **black**.
If a **black** ball is drawn: **Get $ 5**

3 out of 100 balls are **gold**.
If a **gold** ball is drawn: **Get $ 5**

3 out of 100 balls are **gray**.
If a **gray** ball is drawn: **Get $ 5**

6 out of 100 balls are **purple**.
If a **purple** ball is drawn: **Get $ 5**

You will always know how many balls of a given color are contained in the bag before making your decision. The lotteries will actually be played out by the computer and determine your earnings in exactly the way we describe on the following page.

In total, we have created 6 lotteries. For each lottery, you will make decisions on two consecutive decision screens.

- Decision screen 1: You will make various choices to indicate **how much** a lottery is worth to you.
- Decision screen 2: You will indicate **how certain** you are about how much **exactly** a lottery is worth to you.

Throughout the experiment, there are no right or wrong answers, because how much you like a lottery depends on your personal taste. We are only interested in learning about what you prefer.

Decision screen 1

On decision screen 1, you will be asked to choose which of two payment options you prefer. You will see choice lists such as the one below, where each row is a separate choice. In every list, the left-hand side option (Option A) is one of the lotteries that we generated, which is identical in all rows. Here, you can see how many balls of each color are contained in the bag that determines your payment. The right-hand side option (Option B) is a safe payment that you would receive *with certainty*, so there is no risk attached. This safe payment in Option B increases as you go down the list.

You should consider the choice in each row **independently** of all other rows, because in the end one row will be randomly selected for payout and you will receive the option that you selected in that row. In some choice lists that you complete, you will receive a budget. If so, this budget will be listed at the top of your screen and paid out to you along with the payouts from the lottery.

Usually, people start by preferring Option A for small certain amounts (at the top of the list). At some point they switch to Option B as they proceed down the list, because the certain amount associated with Option B increases, so that Option B becomes more attractive. **Thus, an effective way to complete these choice lists is to determine in which row you would like to switch from Option A to Option B.**

Based on your decisions in this choice list, we assess **how much the lottery is worth to you by using those certain payments where you switch from Option A to Option B.** For example, in the example choice list below, the lottery would be worth between $13 and $14 to you, because this is where switching occurs.

Option A		Option B
70 out of 100 balls are **red**. If a **red** ball is drawn: **Get $ 20** **3** out of 100 balls are **blue**. If a **blue** ball is drawn: **Get $ 5** **3** out of 100 balls are **green**. If a **green** ball is drawn: **Get $ 5** **3** out of 100 balls are **orange**. If a **orange** ball is drawn: **Get $ 5** **3** out of 100 balls are **brown**. If a **brown** ball is drawn: **Get $ 5** **3** out of 100 balls are **pink**. If a **pink** ball is drawn: **Get $ 5** **3** out of 100 balls are **black**. If a **black** ball is drawn: **Get $ 5** **3** out of 100 balls are **gold**. If a **gold** ball is drawn: **Get $ 5** **3** out of 100 balls are **gray**. If a **gray** ball is drawn: **Get $ 5** **6** out of 100 balls are **purple**. If a **purple** ball is drawn: **Get $ 5**		With certainty: **Get $ 0**
		With certainty: **Get $ 1**
		With certainty: **Get $ 2**
		With certainty: **Get $ 3**
		With certainty: **Get $ 4**
		With certainty: **Get $ 5**
		With certainty: **Get $ 6**
		With certainty: **Get $ 7**
		With certainty: **Get $ 8**
		With certainty: **Get $ 9**
		With certainty: **Get $ 10**
		With certainty: **Get $ 11**
		With certainty: **Get $ 12**
		With certainty: **Get $ 13**
		With certainty: **Get $ 14**
		With certainty: **Get $ 15**
		With certainty: **Get $ 16**
		With certainty: **Get $ 17**
		With certainty: **Get $ 18**
		With certainty: **Get $ 19**
		With certainty: **Get $ 20**

Click "Next" to read about decision screen 2.

Next

Decision screen 2 (for the same lottery)

For any given lottery, you may actually be **uncertain about how much money it is really worth** to you. For some lotteries, you may know exactly how much they are worth to you. For other lotteries, you may feel uncertain about whether a lottery is worth, say, $12, $13, $14, $15, or $16 to you.

On the second decision screen for a given lottery, we will hence ask you to use a slider to indicate **how certain** you are that your decisions on the first decision screen correspond **exactly** to how much the lottery is **worth to you**.

- The slider is linked to the statement below the slider. As you move around the slider, the values in this statement change. Your task is to position the slider in such a way that the statement corresponds to how you feel about the lottery.
- The **further you move the slider to the right, the more certain** you are about how much exactly the lottery is worth to you.
- For every step that you move the slider **further to the left (the less certain you are)**, the range of dollar values that you consider possible increases by $0.50.

Example

Suppose that on the first decision screen you indicated that the lottery below is worth between $13 and $14 to you (because you switched from Option A to B between $13 and $14). Your screen would then look like this:

Example lottery:

70 out of 100 balls are **red**.
If a **red** ball is drawn: **Get $ 20**

3 out of 100 balls are **blue**.
If a **blue** ball is drawn: **Get $ 5**

3 out of 100 balls are **green**.
If a **green** ball is drawn: **Get $ 5**

3 out of 100 balls are **orange**.
If a **orange** ball is drawn: **Get $ 5**

3 out of 100 balls are **brown**.
If a **brown** ball is drawn: **Get $ 5**

3 out of 100 balls are **pink**.
If a **pink** ball is drawn: **Get $ 5**

3 out of 100 balls are **black**.
If a **black** ball is drawn: **Get $ 5**

3 out of 100 balls are **gold**.
If a **gold** ball is drawn: **Get $ 5**

3 out of 100 balls are **gray**.
If a **gray** ball is drawn: **Get $ 5**

6 out of 100 balls are **purple**.
If a **purple** ball is drawn: **Get $ 5**

How certain are you that to you this lottery **is worth *exactly* the same as getting between $13 and $14** for sure?

very uncertain **completely certain**

I am certain that the lottery is worth **Use the slider!** to me.

Next

Your payment for part 1

If this part is randomly selected for payment in the end, your *additional* bonus will be determined as follows:

The computer will randomly select one choice list for payout, with equal probability. We then randomly select one of your decisions from this choice list (with equal probability), and this decision will be implemented for real payment.

Thus, you should take each decision independently of all other decisions as if it's the one that counts, because it may be.

Next

Comprehension questions

The questions below test your understanding of the instructions.

Important: If you fail to answer any one of these questions correctly, you will not be allowed to participate in the rest of the study, and you will not be able to earn a bonus.

1. Which one of the following statements is correct if the following lottery is played for you?

60 out of 100 balls are **red**.
If a **red** ball is drawn: **Get $ 15**

4 out of 100 balls are **blue**.
If a **blue** ball is drawn: **Get $ 5**

4 out of 100 balls are **green**.
If a **green** ball is drawn: **Get $ 5**

4 out of 100 balls are **orange**.
If a **orange** ball is drawn: **Get $ 5**

4 out of 100 balls are **brown**.
If a **brown** ball is drawn: **Get $ 5**

4 out of 100 balls are **pink**.
If a **pink** ball is drawn: **Get $ 5**

4 out of 100 balls are **black**.
If a **black** ball is drawn: **Get $ 5**

4 out of 100 balls are **gold**.
If a **gold** ball is drawn: **Get $ 5**

4 out of 100 balls are **gray**.
If a **gray** ball is drawn: **Get $ 5**

8 out of 100 balls are **purple**.
If a **purple** ball is drawn: **Get $ 5**

Please select one of the statements:

- ○ It is possible that I get paid both \$15 and \$5, i.e., I may receive a total amount of \$20 from this lottery.
- ○ Only one of the colors will be drawn, hence I receive EITHER \$15 OR \$5 from this lottery.
- ○ It is possible that I receive no money from this lottery.

2. Suppose a person made the decisions shown in the picture below. Which of the following statements is correct regarding these decisions?

Option A			Option B
60 out of 100 balls are **red**. If a **red** ball is drawn: **Get \$ 15** **4** out of 100 balls are **blue**. If a **blue** ball is drawn: **Get \$ 5** **4** out of 100 balls are **green**. If a **green** ball is drawn: **Get \$ 5** **4** out of 100 balls are **orange**. If a **orange** ball is drawn: **Get \$ 5** **4** out of 100 balls are **brown**. If a **brown** ball is drawn: **Get \$ 5** **4** out of 100 balls are **pink**. If a **pink** ball is drawn: **Get \$ 5** **4** out of 100 balls are **black**. If a **black** ball is drawn: **Get \$ 5** **4** out of 100 balls are **gold**. If a **gold** ball is drawn: **Get \$ 5** **4** out of 100 balls are gray. If a gray ball is drawn: **Get \$ 5** **8** out of 100 balls are **purple**. If a **purple** ball is drawn: **Get \$ 5**	●	○	With certainty: **Get \$ 0**
	●	○	With certainty: **Get \$ 1**
	●	○	With certainty: **Get \$ 2**
	●	○	With certainty: **Get \$ 3**
	●	○	With certainty: **Get \$ 4**
	●	○	With certainty: **Get \$ 5**
	●	○	With certainty: **Get \$ 6**
	●	○	With certainty: **Get \$ 7**
	●	○	With certainty: **Get \$ 8**
	○	●	With certainty: **Get \$ 9**
	○	●	With certainty: **Get \$ 10**
	○	●	With certainty: **Get \$ 11**
	○	●	With certainty: **Get \$ 12**
	○	●	With certainty: **Get \$ 13**
	○	●	With certainty: **Get \$ 14**
	○	●	With certainty: **Get \$ 15**

Please select one of the statements:

- ○ This person indicated that the lottery is worth more to them than \$9.
- ○ This person indicated that the lottery is worth between \$3 and \$7 to them.
- ○ This person indicated that the lottery is worth between \$8 and \$9 to them.

3. Now imagine that the person who made the decisions above is uncertain about how much exactly the lottery is worth to them.
This person is certain, however, that the lottery is worth between \$6 and \$11 to them. Please position the slider to accurately reflect this level of certainty:

very uncertain **completely certain**

This person is certain that the lottery is worth **Use the slider!** to them.

Next

J.3 Treatment *Baseline Beliefs*

Welcome

Thank you for participating in this study.

This study will take approximately 25 minutes to complete.

You will earn a fixed reward of $0.50. In addition, you can earn a bonus if you complete the study. To complete the study, you will need to read all instructions carefully and answer the corresponding comprehension questions correctly. You receive a minimum bonus of $1.20 when you complete the study.

You can earn an ***additional* bonus**. At the end of the study, one of the tasks will be randomly selected and your decision in this task determines your additional bonus. The chance that you get paid an additional bonus for the first part is 1 in 3.

Important information

- You should think about each task **independently** of all other tasks in this study. There is no point in strategizing across tasks.
- You will note that we sometimes ask you to work on similar-sounding tasks. Theses tasks might have similar answers, or very different ones. Please consider each individual task **carefully**.
- Whenever a task involves a random draw, then this random draw will **actually be implemented for you by the computer** in exactly the way it is described to you in the task.

Next

Part 1: The guessing tasks

Please read these instructions carefully. We will test your understanding of them later.

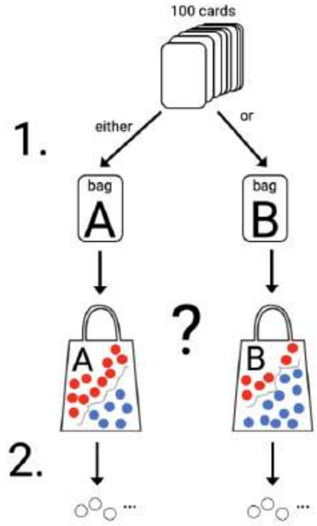
In this study, you will be asked to complete **6 guessing tasks**.
In each guessing task, there are two bags, "bag A" and "bag B". Each bag contains 100 balls, some of which are red and some of which are blue. One of the bags is selected at random by the computer as described below. You will not observe which bag was selected. Instead, the computer will then randomly draw one or several balls from the secretly selected bag, and will show these balls to you. Your task is to **guess which bag was selected** based on the available information. The exact procedure is described below:

Task setup

- There is a deck of cards that consists of 100 cards. Each card in the deck either has "bag A" or "bag B" written on it. You will be informed about **how many** of these 100 cards have "bag A" or "bag B" written on them.
- There are two bags, "bag A" and "bag B". You will be informed about **how many red and blue balls** each bag contains.

Sequence of events

1. The computer **randomly selects one** of the 100 cards, with equal probability.
   If a "bag A" card was drawn, bag A is selected.
   If a "bag B" card was drawn, bag B is selected.
2. Next, the computer **randomly draws one or more** balls from the secretly selected bag. Each ball is equally likely to get selected. Importantly, if more than one ball is drawn, the computer draws these balls **with replacement**. This means that after a ball has been drawn and taken out of the bag, it gets replaced by a ball of the same color. Thus, the probability of a red or blue ball being drawn does not depend on whether previous draws were red or blue.
   The computer will **inform you about the color** of the randomly drawn balls.



You then make your guess by **stating a probability between 0% and 100%** that bag A was drawn. The corresponding probability that bag B was drawn is 100 minus your stated probability that bag A was drawn.

Please note:

- The number of "bag A" and "bag B" cards **varies across the guessing tasks**.
- The number of red and blue balls in each bag **varies across the guessing tasks**.
- The computer **draws a new card in each task**, so you should **think about which bag was selected in a task independently** of all other tasks.

Next

Your payment for part 1

There is a **prize of $10.00**. Whether or not you receive the $10.00 depends on how much probability you assigned to the bag that was *actually drawn* in that problem.

This means: if bag A was selected, your chances of receiving $10.00 are greater the higher the probability you assigned to bag A. If bag A was not selected, your chances of receiving $10.00 are greater the lower the probability you assigned to bag A. In case you're interested, the specific method that determines whether you get the prize is explained below:

A number q between 0 and 2500 is randomly drawn by the computer.
If bag A was selected in that problem, you receive $10.00 if the square of the probability (in percent) that you assigned to bag B is *lower than q*.
If bag A was not selected in that problem, you receive $10.00 if the square of the probability (in percent) that you assigned to bag A is *lower than q*.

All this means that, in order to earn as much money as possible, you should try to give your best estimate of the probability that each bag was drawn. For example, if you are 80% sure that bag A was selected and 20% sure that bag B was selected, you should allocate probability 80% to bag A and 20% to bag B.

Next

Your **certainty** about your guess

The optimal guess

Using the laws of probability, the computer computes a **statistically correct statement of the probability that bag A was drawn**, based on all the information available to you. This **optimal guess** does not rely on information that you do not have. It is just the best possible (this means: payoff-maximizing) estimate given the available information. In technical terms, this guess is based on a statistical rule called Bayes' Law.

Your certainty about your guess

In any given task, you may actually be **uncertain about whether your probability guess corresponds to the optimal guess**. On a separate decision screen, we will hence ask you to use a slider to indicate **how certain** you are that your guess equals the optimal guess.

- The slider is linked to the statement below the slider. As you move around the slider, the values in this statement change. Your task is to position the slider in such a way that the statement corresponds to how close you think your guess is to the optimal guess.
- The further you move the slider to the right, the more certain you are that your guess is close to the optimal guess.
- For every step that you move the slider further to the left (the less certain you are), the range of probability values that you consider possible increases by 2.

Example

Suppose that you stated a guess of 80%. Your screen would then look like this:

How certain are you that **the *optimal* guess is *exactly* 80%**?

Use the slider to complete the statement below.

very uncertain **completely certain**

I am certain that the optimal guess of the **probability that bag A** was drawn is **Use the slider!**.

Replacing your guess by the optimal guess

In each task, if you are **uncertain about what you should guess**, you may **increase your chances of winning** the prize of $10.00 by paying money to **replace your guess with the optimal guess**.

For this purpose, in each task, you receive a budget of $3.00. You then have to state the **highest amount (between $0.00 and $3.00) that you are willing to pay to replace your guess with the optimal guess.** In the end, a price p between $0.00 and $3.00 will be randomly determined by the computer. You will purchase the optimal guess at price *p* if *p* is below your stated amount, and you will not purchase the optimal guess and keep your endowment otherwise. If you buy the optimal guess, your own guess is replaced with the optimal guess with 10% probability. You only have to pay for the optimal guess if your guess actually gets replaced.

Next

Sequence of events in each task

You will be asked to complete 6 guessing tasks. For each task, there will be **3 decision screens:**

Decision screen 1

You will be asked to state the highest amount that you are **willing to pay** to **replace your own guess** (that you will make on decision screen 2) with the **optimal guess in this task.**

Decision screen 2

You have to guess which bag was selected by entering a probability (between 0 and 100) that expresses **how likely** you think it is that bag A as opposed to bag B have been selected.

Decision screen 3

You will be asked to indicate **how certain** you are that the guess you provided on decision screen 1 **equals the optimal guess in this task**.

Next

Comprehension questions

The following questions test your understanding of the instructions.

Important: If you fail to answer any one of these questions correctly, you will not be allowed to participate in the rest of the study, and you will not be able to earn a bonus.

Which statement about the number of cards corresponding to each bag is correct?

- ○ The number of "bag A" cards is the same in all tasks.
- ○ The exact number of cards corresponding to each bag may vary across tasks.

Which statement about the allocation of red and blue balls in the bags is correct?

- ○ The exact fractions of red and blue balls in each bag may vary across tasks.
- ○ The fraction of red balls in each bag is the same in all tasks, and bag A always contains the most red balls.

Which statement about your bonus payment is correct?

- ○ Purchasing the optimal guess always means that I would make a loss.
- ○ By purchasing the optimal guess I can potentially increase my earnings in the guessing tasks if my own guess is not sufficiently good.

In order to maximize your overall profit, how should you determine how much you are willing to pay for the optimal guess?

- ○ I should be willing to pay a high amount if I think that my own guess will probably not be optimal.
- ○ I should be willing to pay a high amount if I think that my own guess will probably be optimal.
- ○ I should never pay money for the optimal guess because it costs money but has no benefits.

Next

J.4 Treatment *Low Default Beliefs*

Welcome

Thank you for participating in this study.

This study will take approximately 25 minutes to complete.

You will earn a fixed reward of $0.50. In addition, you can earn a bonus if you complete the study. To complete the study, you will need to read all instructions carefully and answer the corresponding comprehension questions correctly. You receive a minimum bonus of $1.20 when you complete the study.

You can earn an ***additional*** **bonus**. At the end of the study, one of the tasks will be randomly selected and your decision in this task determines your additional bonus. The chance that you get paid an additional bonus for the first part is 1 in 3.

Important information

- You should think about each task **independently** of all other tasks in this study. There is no point in strategizing across tasks.
- You will note that we sometimes ask you to work on similar-sounding tasks. Theses tasks might have similar answers, or very different ones. Please consider each individual task **carefully**.
- Whenever a task involves a random draw, then this random draw will **actually be implemented for you by the computer** in exactly the way it is described to you in the task.

Next

Part 1: The guessing tasks

Please read these instructions carefully. We will test your understanding of them later.

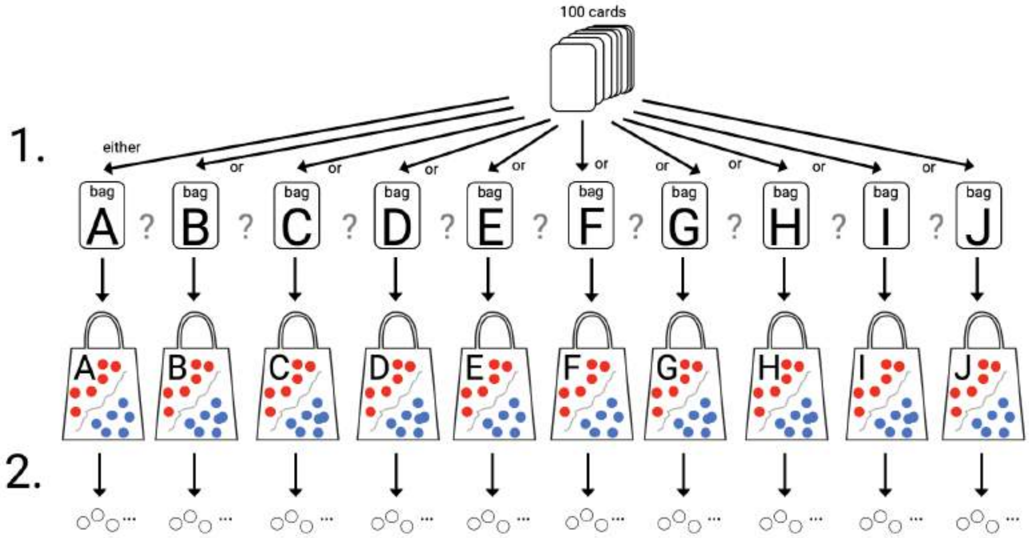
In this study, you will be asked to complete **6 guessing tasks**.
In each guessing task, there are ten bags, "bag A", "bag B", "bag C", "bag D", "bag E", "bag F", "bag G", "bag H", "bag I" and "bag J". Each bag contains 100 balls, some of which are red and some of which are blue. One of the bags is selected at random by the computer as described below. You will not observe which bag was selected. Instead, the computer will then randomly draw one or several balls from the secretly selected bag, and will show these balls to you. Your task is to **guess which bag was selected** based on the available information. The exact procedure is described below:

Task setup

- There is a deck of cards that consists of 100 cards. Each card in the deck either has "bag A", "bag B", "bag C", "bag D", "bag E", "bag F", "bag G", "bag H", "bag I" or "bag J" written on it.
- You will be informed about **how many** of these 100 cards have "bag A", "bag B", ..., or "bag J" written on them.
- There are ten bags, "bag A" through "bag J". You will be informed about **how many red and blue balls** each bag contains.

Sequence of events

1. The computer **randomly selects one** of the 100 cards, with equal probability.
   If a "bag A" card was drawn, bag A is selected.
   If a "bag B" card was drawn, bag B is selected.
   ... etc. ...
2. Next, the computer **randomly draws one or more** balls from the secretly selected bag. Each ball is equally likely to get selected. Importantly, if more than one ball is drawn, the computer draws these balls **with replacement.** This means that after a ball has been drawn and taken out of the bag, it gets replaced by a ball of the same color. Thus, the probability of a red or blue ball being drawn does not depend on whether previous draws were red or blue.
   The computer will **inform you about the color** of the randomly drawn balls.



You then make your guess by **stating a probability between 0% and 100%** that bag A was drawn. The corresponding probability that one of bag B, C, D, E, F, G, H, I or J was drawn is 100 minus your stated probability that bag A was drawn.

Please note:

- The number of "bag A", "bag B", ..., and "bag J" cards **varies across the guessing tasks.**
- The number of red and blue balls in each bag **varies across the guessing tasks.**
- The computer **draws a new card in each task**, so you should **think about which bag was selected in a task independently** of all other tasks.

Next

Your payment for part 1

There is a **prize of $10.00**. Whether or not you receive the $10.00 depends on how much probability you assigned to the bag that was *actually drawn* in that problem.

This means: if bag A was selected, your chances of receiving $10.00 are greater the higher the probability you assigned to bag A. If bag A was not selected, your chances of receiving $10.00 are greater the lower the probability you assigned to bag A. In case you're interested, the specific method that determines whether you get the prize is explained below:

A number q between 0 and 2500 is randomly drawn by the computer.
If bag A was selected in that problem, you receive $10.00 if the square of the probability (in percent) that you assigned to all other bags is *lower than q*.
If bag A was not selected in that problem, you receive $10.00 if the square of the probability (in percent) that you assigned to bag A is *lower than q*.

All this means that, in order to earn as much money as possible, you should try to give your best estimate of the probability that each bag was drawn. For example, if you are 80% sure that bag A was selected and 20% sure that any bag other than bag A was selected, you should allocate probability 80% to bag A and 20% to bag B.

Next

Your **certainty** about your guess

The optimal guess

Using the laws of probability, the computer computes a **statistically correct statement of the probability that bag A was drawn**, based on all the information available to you. This **optimal guess** does not rely on information that you do not have. It is just the best possible (this means: payoff-maximizing) estimate given the available information. In technical terms, this guess is based on a statistical rule called Bayes' Law.

Your certainty about your guess

In any given task, you may actually be **uncertain about whether your probability guess corresponds to the optimal guess**. On a separate decision screen, we will hence ask you to use a slider to indicate **how certain** you are that your guess equals the optimal guess.

- The slider is linked to the statement below the slider. As you move around the slider, the values in this statement change. Your task is to position the slider in such a way that the statement corresponds to how close you think your guess is to the optimal guess.
- The further you move the slider to the right, the more certain you are that your guess is close to the optimal guess.
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Example

Suppose that you stated a guess of 80%. Your screen would then look like this:

How **certain** are you that **the *optimal* guess is *exactly* 80%**?

Use the slider to complete the statement below.

very uncertain | **completely certain**

I am certain that the optimal guess of the **probability that bag A** was drawn is **Use the slider!**.

Replacing your guess by the optimal guess

In each task, if you are **uncertain about what you should guess**, you may **increase your chances of winning** the prize of $10.00 by paying money to **replace your guess with the optimal guess.**

For this purpose, in each task, you receive a budget of $3.00. You then have to state the **highest amount (between $0.00 and $3.00) that you are willing to pay to replace your guess with the optimal guess.** In the end, a price p between $0.00 and $3.00 will be randomly determined by the computer. You will purchase the optimal guess at price *p* if *p* is below your stated amount, and you will not purchase the optimal guess and keep your endowment otherwise. If you buy the optimal guess, your own guess is replaced with the optimal guess with 10% probability. You only have to pay for the optimal guess if your guess actually gets replaced.

Next

Sequence of events in each task

You will be asked to complete 6 guessing tasks. For each task, there will be **3 decision screens:**

Decision screen 1

You will be asked to state the highest amount that you are **willing to pay** to **replace your own guess** (that you will make on decision screen 2) with the **optimal guess in this task**.

Decision screen 2

You have to guess which bag was selected by entering a probability (between 0 and 100) that expresses **how likely** you think it is that bag A as opposed to any bag other than bag A have been selected.

Decision screen 3

You will be asked to indicate **how certain** you are that the guess you provided on decision screen 1 **equals the optimal guess in this task**.

Next

Comprehension questions

The following questions test your understanding of the instructions.

Important: If you fail to answer any one of these questions correctly, you will not be allowed to participate in the rest of the study, and you will not be able to earn a bonus.

Which statement about the number of cards corresponding to each bag is correct?

- ○ The number of "bag A" cards is the same in all tasks.
- ○ The exact number of cards corresponding to each bag may vary across tasks.

Which statement about the allocation of red and blue balls in the bags is correct?

- ○ The exact fractions of red and blue balls in each bag may vary across tasks.
- ○ The fraction of red balls in each bag is the same in all tasks, and bag A always contains the most red balls.

Which statement about your bonus payment is correct?

- ○ Purchasing the optimal guess always means that I would make a loss.
- ○ By purchasing the optimal guess I can potentially increase my earnings in the guessing tasks if my own guess is not sufficiently good.

In order to maximize your overall profit, how should you determine how much you are willing to pay for the optimal guess?

- ○ I should be willing to pay a high amount if I think that my own guess will probably not be optimal.
- ○ I should be willing to pay a high amount if I think that my own guess will probably be optimal.
- ○ I should never pay money for the optimal guess because it costs money but has no benefits.

Next

J.5 Survey Expectations

Part 2 of this study

You have completed part 1. We will now continue with part 2 of this study.

Next

Your payment for part 2

In this part, there will be 3 tasks. At the end, one of the tasks will be randomly selected to count for your potential bonus. The chance that you get paid an additional bonus for this part is 1 in 3.

In each task, you will be asked to **state a guess in the form a probability estimate (between 0 and 100).**

There is a **prize of $2.00**. In each guessing task, there are two possible events, call them A and B. One of the two events actually occurred, the other did not. Whether or not you receive the $2.00 depends on **how much probability** you assigned to the **event that actually occurred**.

If event A occurred, your chances of receiving $2.00 are greater the higher the probability you assigned to event A. If event B occurred, your chances of receiving $2.00 are greater the higher the probability you assigned to event B.

In case you're interested, the specific method that determines whether you get the prize is explained below:

A number **q** between 0 and 2,500 is randomly drawn by the computer.

- If event A occurred in that problem, you receive $2.00 if the square of the probability (in percent) that you assigned to event B is *lower than q*.
- If event B occurred in that problem, you receive $2.00 if the square of the probability (in percent) that you assigned to event A is *lower than q*.

All this means that, in order to earn as much money as possible, you should try to provide your best probability estimate in each task.

Next

The study begins on the next page

We will now start with part 2 of study.

Next