Willingness-to-pay for Warnings: Main Tables

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Hypotheses

1. Conditional on the signal's value for risk-neutral subjects, false positive and false negative rates reduce the perceived value of the signal (WTP)
    - *The opposite is true: subjects underreact to false positive and false negative rates and overpay for bad signals*
2. Conditional on the signal's value for risk-neutral subjects, false positive and false negative rates increase expected costs
    - *No: FP and FN rates have no significant effects on costs besides their predicted theoretical effect*
3. Extra: how much of these disrepancies result from belief updating issues or risk aversion?

WTP for the Signal

- Theoretical value of the signal for risk-neutral subject:

$$b^* = \underbrace{\min[\pi L, c]}_{\text{BP costs}} - \underbrace{\pi(1 - P(s = 0|\omega = 1))L}_{\text{False neg. costs}} - \underbrace{P(s = 1)c}_{\text{Protection costs}}$$

- Two potential approaches:
  1. Regress the discrepancy between WTP V and theoretical value b^*:

$$V - b^* = \alpha_0 + \alpha_1 \text{FN costs} + \alpha_2 \text{Prot. costs} + \epsilon$$

  2. Regress WTP directly on its components and account for censoring at 0:

$$V = \min[0, \beta_0 + \beta_1 \text{FN costs} + \beta_2 \text{Prot. costs} - \beta_3 \text{BP costs} + \gamma]$$

  3. Note: protection costs include costs due to false positive signals

WTP Discrepancy Regressions

- Regressing the difference between WTP and theoretical value for a risk-neutral subject
- Coefficients should be zero

Actual Costs vs Theoretical Costs

- Calculate actual costs based on decisions made in the Informed Protection treatment and actual posterior probabilities of losses.
- Each reported participant's strategy s is a tuple of numbers (r_w, r_b) representing protection responses correspondingly to white and black hints
- Then the expected cost of each decision are:

$$EC(s) = \pi(P(0|1)(1 - r_w) + P(1|1)(1 - r_b))L + P(s = 1)c$$

$$+(P(s = 0)r_w + P(s = 1)r_b)c$$

- Regress expected costs on minimal theoretical costs and other signal characteristics

Actual Costs vs Theoretical Costs

- Prior prob and false negative rates disproportionally affect expected costs:

Table: Actual Exp. Costs vs Theoretical Costs

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE
Optimal exp. costs	.979***	.549***	.987***	.733***	1.06***
	(13.1)	(2.9)	(11.5)	(6.0)	(10.2)
Prior prob.	-.689	-3.3**	-.607	-2.15**	-.18
	(-0.9)	(-2.5)	(-0.8)	(-2.5)	(-0.2)
False neg. rate		-2.48***		-1.88***	
		(-3.4)		(-3.1)	
False pos. rate		-1.04			.71
		(-1.4)			(1.0)
Constant	-.707***	-.542***	-.711***	-.637***	-.754***
	(-6.2)	(-4.5)	(-7.4)	(-6.6)	(-6.8)
Observations	743	743	743	743	743
Adjusted R^2	0.38	0.39	0.43	0.44	0.43

t statistics in parentheses

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

WTP Discrepancy 1

Table: WTP for Information (Discrepancy)

	(1)	(2)	(3)	(4)	(5)	(6)
False pos. costs	.17	.213**	.062	.0744	.338**	.37
	(1.6)	(2.3)	(0.4)	(0.5)	(2.3)	(2
False neg. costs	.3***	.246***	.329***	.314***	.367***	.32
	(4.8)	(4.2)	(3.3)	(3.4)	(4.0)	(3
Risk-averse			-.00425	-.231		
			(-0.0)	(-0.9)		
Risk-averse × False pos. costs			.145	.217		
			(0.7)	(1.1)		
Risk-averse × False neg. costs			-.0312	-.125		
			(-0.2)	(-1.0)		
Accur. beliefs					.132	.2
					(0.7)	(0
Accur. beliefs × False pos. costs					-.381*	-.3
					(-1.9)	(-2
Accur. beliefs × False neg. costs					-.133	-.1
					(-1.1)	(-1
Constant	-.111	.413***	-.139	.463***	-.173	.31
	(-1.2)	(3.4)	(-1.0)	(2.6)	(-1.2)	(1

WTP Discrepancy (Demographics)

Table: WTP for Information (Discrepancy, demographic variables)

	(1)	(2)	(3)	(4)	(5)
Male	-.131	-.107			
	(-0.7)	(-0.4)			
False pos. costs	.196	.256**	.0642	.159	.233**
	(1.5)	(2.1)	(0.4)	(1.0)	(2.0)
Male × False pos. costs	-.0832	-.124			
	(-0.4)	(-0.6)			
False neg. costs	.277***	.208***	.407***	.313***	.272***
	(3.3)	(2.7)	(4.2)	(3.3)	(3.9)
Male × False neg. costs	.0553	.0968			
	(0.4)	(0.8)			
Stat/prob class			-.0936	.0477	
			(-0.5)	(0.2)	
Stat/prob class × False pos. costs			.165	.0859	
			(0.8)	(0.4)	
Stat/prob class × False neg. costs			-.189	-.116	
			(-1.5)	(-1.0)	
>24 yrs					.0397
					(0.2)

WTP Discrepancy 5 (by Risk Aversion)

- Explaining the discrepancy between WTP and value with risk aversion:

Table: WTP for Information (different risk aversion)

	(1) $\theta = 0$	(2) $\theta = 0.5$	(3) $\theta = 1.0$	(4) $\theta = 1.5$	(5) $\theta = 2.5$	(6) Heterogeneous θ
False pos. costs	.213**	.246***	.246***	.201**	.0858	.162
	(2.3)	(2.6)	(2.6)	(2.1)	(0.8)	(1.3)
False neg. costs	.246***	.348***	.46***	.556***	.687***	.234***
	(4.2)	(5.9)	(7.5)	(8.8)	(10.2)	(3.2)
Constant	.413***	.0134	-.505***	-1.16***	-1.66***	-.0609
	(3.4)	(0.1)	(-4.1)	(-9.5)	(-12.8)	(-0.4)
Prior dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	744	744	744	744	744	594
Adjusted R^2	0.20	0.25	0.26	0.30	0.35	0.12

t statistics in parentheses

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

Actual Costs - Theoretical Costs Discrepancy

- Prior prob and false negative rates disproportionally affect expected costs:

Table: Discrepancy: actual-theoretical Costs

	(1) OLS	(2) OLS	(3) FE	(4) FE
False pos. costs	.0438	.0142	.0336	.00252
	(0.4)	(0.1)	(0.3)	(0.0)
False neg. costs	-.0137	.0227	-.00554	.0221
	(-0.2)	(0.3)	(-0.1)	(0.3)
Constant	-.857***	-.706***	-.858***	-.823***
	(-8.9)	(-6.4)	(-11.2)	(-8.9)
Prior prob dummies	No	Yes	No	Yes
Observations	743	743	743	743
Adjusted R^2	-0.00	-0.00	-0.00	-0.00

t statistics in parentheses

$^{*}\ p < 0.10,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$

Actual Costs - Theoretical Costs Discrepancy 2

- Prior prob and false negative rates disproportionally affect expected costs:

Table: Discrepancy 2: actual-theoretical Costs

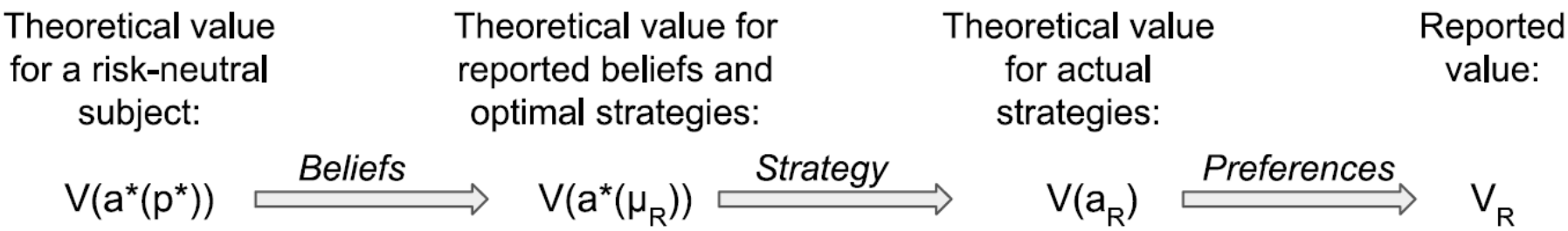
	(1) OLS	(2) OLS	(3) FE	(4) FE
False pos. rate	.443	.447	.657	.659
	(1.1)	(1.1)	(1.1)	(1.1)
False neg. rate	-.812**	-.814**	-.862*	-.864*
	(-2.0)	(-2.0)	(-1.9)	(-1.9)
Constant	-.803***	-.649***	-.823***	-.783***
	(-8.1)	(-6.3)	(-9.9)	(-8.1)
Prior prob dummies	No	Yes	No	Yes
Observations	743	743	743	743
Adjusted R^2	0.00	0.00	0.01	0.01

t statistics in parentheses

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

Value Formation

- What drives the difference between theoretical value and actual willingness-to-pay? Potential elements affecting the WTP:
  - Beliefs
  - Strategies
  - Preferences
- We recalculate the value after incorporating these elements one-by-one



Value Formation

- Accounting for reported beliefs or strategies does not make the theoretical value closer to the WTP
- WTP is still more correlated with the (completely) theoretical value rather than with values accounting for beliefs μ_R or strategies a_R
- My hypothesis: subjects approach the tasks independently and/or do not report beliefs truthfully

	$V(a^*(p^*))$	$V(a^*(\mu_R))$	$V(a_R)$	V_R
$V(a^*(p^*))$	1	0.52	0.54	0.34
$V(a^*(\mu_R))$	0.52	1	0.63	0.29
$V(a_R)$	0.54	0.63	1	0.33
V_R	0.34	0.29	0.33	1

Additional Complementary Tables

1. Belief updating (slides are not updated)
2. Determinants of informed protection responses
3. Classifying informed protection strategies
4. Extra WTP tables

Belief Updating: Correlation

Table: Belief Elicitation: Belief vs Posterior

	(1) All	(2) Not_honest	(3) Good quiz
Posterior prob.	.644***	.693***	.524***
	(37.5)	(39.2)	(21.8)
Constant	.175***	.15***	.236***
	(21.7)	(19.8)	(23.4)
Observations	1488	1260	992
Adjusted R^2	0.53	0.60	0.38

t statistics in parentheses

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Belief Updating: Decomposition

- Posterior probability $\mu = P(B|S = x)$ that the ball is black conditional on a hint $S = x$ can be written as:

$$\ln\left(\frac{\mu}{1-\mu}\right) = \lambda_0 + S_B + S_W$$

- With $\lambda_0 \equiv \ln(p/(1-p))$ representing (transformed) prior beliefs
- And S_B, S_W describing the effect of new evidence:

$$S_B \equiv I(S = B)\ln(P(s = B|B)/P(s = B|W))$$

$$S_W \equiv I(S = W)\ln((1 - P(s = B|B))/(1 - P(s = B|W))$$

Belief Updating: Decomposition

Table: Belief Elicitation: Decomposition

	(1) OLS	(2) FE	(3) Good quiz, FE
lt_prior	.237***	.182***	.187***
	(3.9)	(4.0)	(4.0)
signalB	.426***	.865***	.992***
	(5.1)	(6.4)	(6.7)
signalW	.439***	0	0
	(5.7)	(.)	(.)
Constant		-.54***	-.632***
		(-6.0)	(-6.6)
Observations	332	332	288
Adjusted R^2	0.29	0.29	0.34

t statistics in parentheses

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

Informed Protection: Determinants

Table: Informed Protection

	(1) All	(2) All	(3) Good quiz	(4) Good quiz
Informed protection				
Posterior prob.	2.15***	.662***	2.26***	.638***
	(19.1)	(3.3)	(17.7)	(3.0)
Prior prob.		1.13***		1.17***
		(4.1)		(3.8)
Gremlin says Black		1.34***		1.46***
		(8.8)		(8.8)
Constant	-.662***	-1.03***	-.717***	-1.1***
	(-14.2)	(-11.2)	(-14.2)	(-10.9)
Observations	1487	1487	1259	1259
AIC	1467.25	1394.01	1211.48	1137.59

t statistics in parentheses

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

Informed Protection: Reacting to Own Beliefs or Posterior Probabilties?

Table: Informed Protection: Response to Reported Beliefs

	(1) All	(2) All	(3) Good quiz
Informed protection			
Belief	2.18***	1.1***	1.39***
	(18.5)	(7.3)	(7.9)
Posterior prob.		1.52***	1.41***
		(11.5)	(9.3)
Constant	-.762***	-.881***	-.963***
	(-14.3)	(-15.7)	(-15.9)
Observations	1487	1487	1259
AIC	1566.82	1413.23	1146.78

t statistics in parentheses

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Informed Protection: Do Subject's Beliefs Matter?

Table: Informed Protection: Response to Reported Beliefs

	(1) All	(2) Accurate beliefs	(3) Inaccurate beliefs
Informed protection			
Belief	1.1***	2.18***	.728***
	(7.3)	(6.9)	(3.8)
Posterior prob.	1.52***	.69**	1.55***
	(11.5)	(2.1)	(10.6)
Constant	-.881***	-.953***	-.807***
	(-15.7)	(-12.8)	(-9.4)
Observations	1487	744	743
AIC	1413.23	603.49	798.79

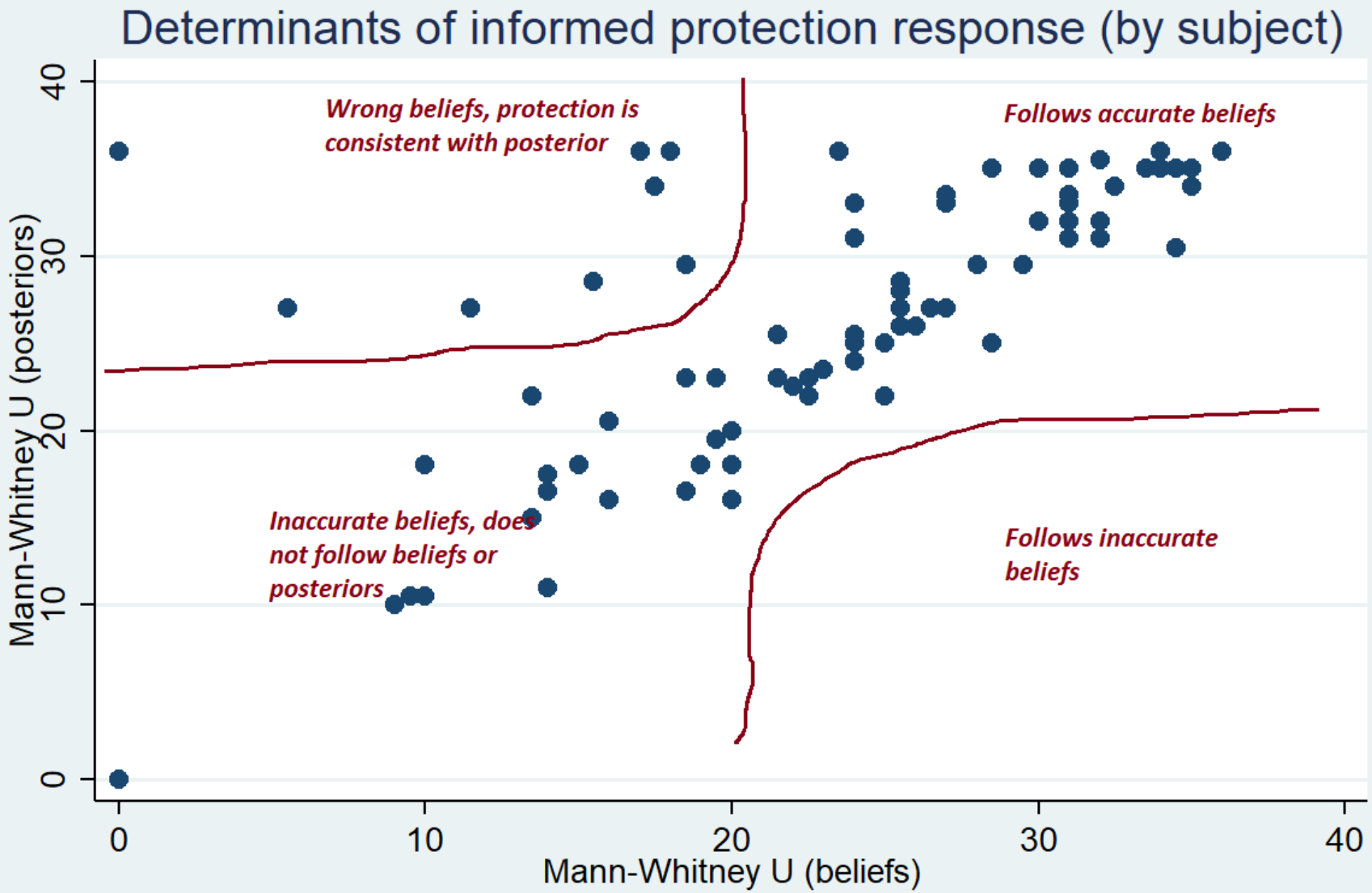
t statistics in parentheses

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

Informed Protection: Responding to Beliefs or Posterior Probabilities

- Calculate the subject-specific correlation between beliefs, posterior probabilities and protection responses
- Mann-Whitney U-test as a correlation measure with two "groups": signals answered with either protection or no protection responses
- No obvious clustering, but $\exists$ three groups:
  1. Sophisticated: protection decisions closely follow their accurate beliefs
  2. Clueless: protection decisions follow neither posteriors nor reported beliefs
  3. Amenders: have inaccurate beliefs, but behave consistently with posterior probabilities (small group)

Informed Protection: Responding to Beliefs or Posterior Probabilities



WTP Discrepancy 6

- Adding blind protection costs

Table: WTP for Information (Discrepancy)

	(1) All	(2) Risk-averse	(3) Risk-loving	(4) Switchers
BP costs	-.519***	-.484***	-.534***	-.622**
	(-9.3)	(-6.2)	(-6.6)	(-2.5)
Pos. signal costs	.671***	.759***	.596***	.482
	(8.0)	(6.8)	(4.5)	(1.4)
False neg. costs	.475***	.423***	.542***	.371*
	(7.3)	(4.6)	(5.2)	(1.7)
Constant	.818***	.526**	.917***	2.06**
	(4.6)	(2.1)	(3.6)	(2.5)
N obs.	744	336	354	54
AIC	2738	1206	1326	210
p(coeffs=0)	3.83e-22***	2.00e-12***	8.46e-10***	.0958*

t statistics in parentheses

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

WTP Discrepancy 7

- Controlling for the prior probability of a black ball with dummies

Table: WTP for Information (Discrepancy)

	(1) All	(2) Risk-averse	(3) Risk-loving	(4) Switchers
False-neg. prob. x Loss	.044**	.0366	.0572**	.0162
	(2.5)	(1.5)	(2.1)	(0.2)
False-neg. prob. x Prot. cost	.13*	.176*	.0378	-.0058
	(1.8)	(1.8)	(0.3)	(-0.0)
Constant	.404***	.244	.417**	1.63**
	(3.1)	(1.3)	(2.2)	(2.5)
N obs.	744	336	354	54
AIC	2686	1174	1303	213
p(coeffs=0)	.00982***	.0542***	.109***	.969

t statistics in parentheses

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