Responsiveness to feedback as a personal trait

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Feedback on abilities

How we deal with feedback on our abilities shapes important life decisions

- What to study?
- Which career to pick?
- Which jobs to apply for?
- Whom to ask on a date?

Feedback is often noisy, leading to potential for biased interpretations.

Biases in updating

People are generally **"conservative"**, i.e less responsive to noisy feedback than perfect Bayesians

Slovic and Lichtenstein 1971, Fischhoff and Beyth-Marom 1983

People may be **"asymmetric"** i.e. react stronger to "good news" than to " bad news"

In **psychology**, discussion about optimism bias

- People update asymmetrically about averse life events

  Sharot et al. 2011, Korn et al. 2012, Sharot 2012

- Does not correct for "rational" updating differences

  Harris and Hahn 2011, Shah et al. 2016

In **economics**, focus on testing Bayes' rule

- People update asymmetrically about ego-related events

  Möbius et al 2014, Eil and Rao 2011

- Number of recent null or counter results

  Ertac 2011, Kuhnen 2015, Barron 2016, Coutts 2016, Gotthard-Real 2017, Schwardmann and van der Weele 2016

This research project

1. Attempt to replicate ego biases in asymmetric and conservative updating.

2. Measure *individual* responsiveness to feedback (conservatism and asymmetry)

   $\rightarrow$ "fingerprint" of motivated cognition

1. Are conservatism and asymmetry stable traits that carry across domains?
   - Different cognitive tasks: numerical, verbal and IQ tests.

2. Does responsiveness change when the ego threat is greater?
   - Students from economics, humanities and sciences.

3. Do individual measures predict economically relevant choices?
   - Willingness to compete

Experimental Design

Experimental design – Timeline

1. Read instructions and answer multiple control questions
2. Perform first of three tasks for 5 minutes
   - Score=#correct answers minus 0.5 times #incorrect answers
   - Payment: 8DKK per point

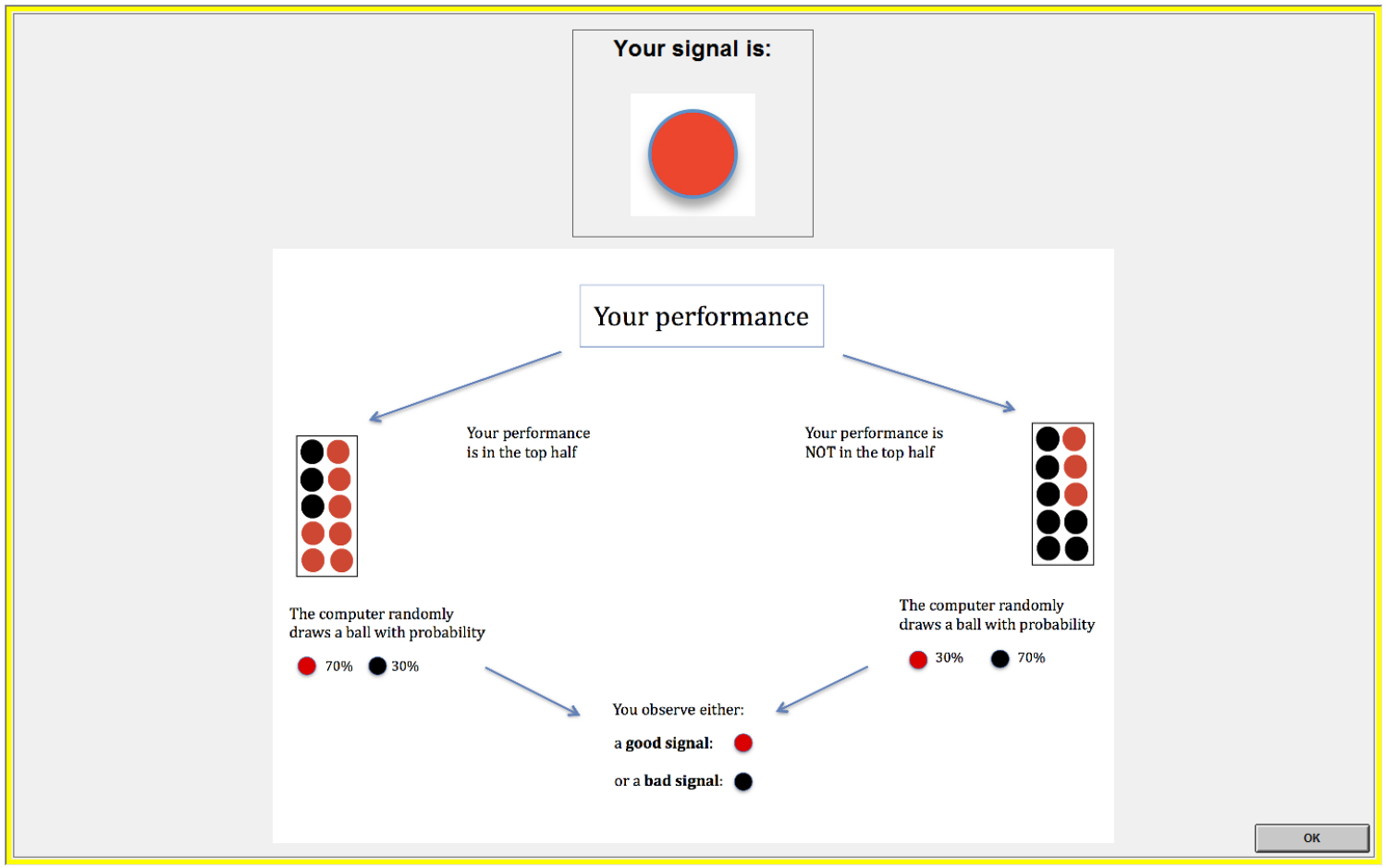
   Three tasks (in random order):
   - *Raven*: "This exercise is designed to measure your general intelligence (IQ)"
   - *Matrix*: "This exercise is designed to measure your mathematical ability"
   - *Anagram*: "This exercise is designed to measure your ability for languages"

Experimental design – Timeline

3. Estimate probability of being in top half of 8 randomly selected performances (prize=10DKK)
   - Subjects indicate the probability p that makes them indifferent between winning the prize with probability p and winning the same prize when being in the top half.

4. Six rounds of feedback:
   - Get noisy signal (P(true)=0.7)
   - Update belief

Experimental design

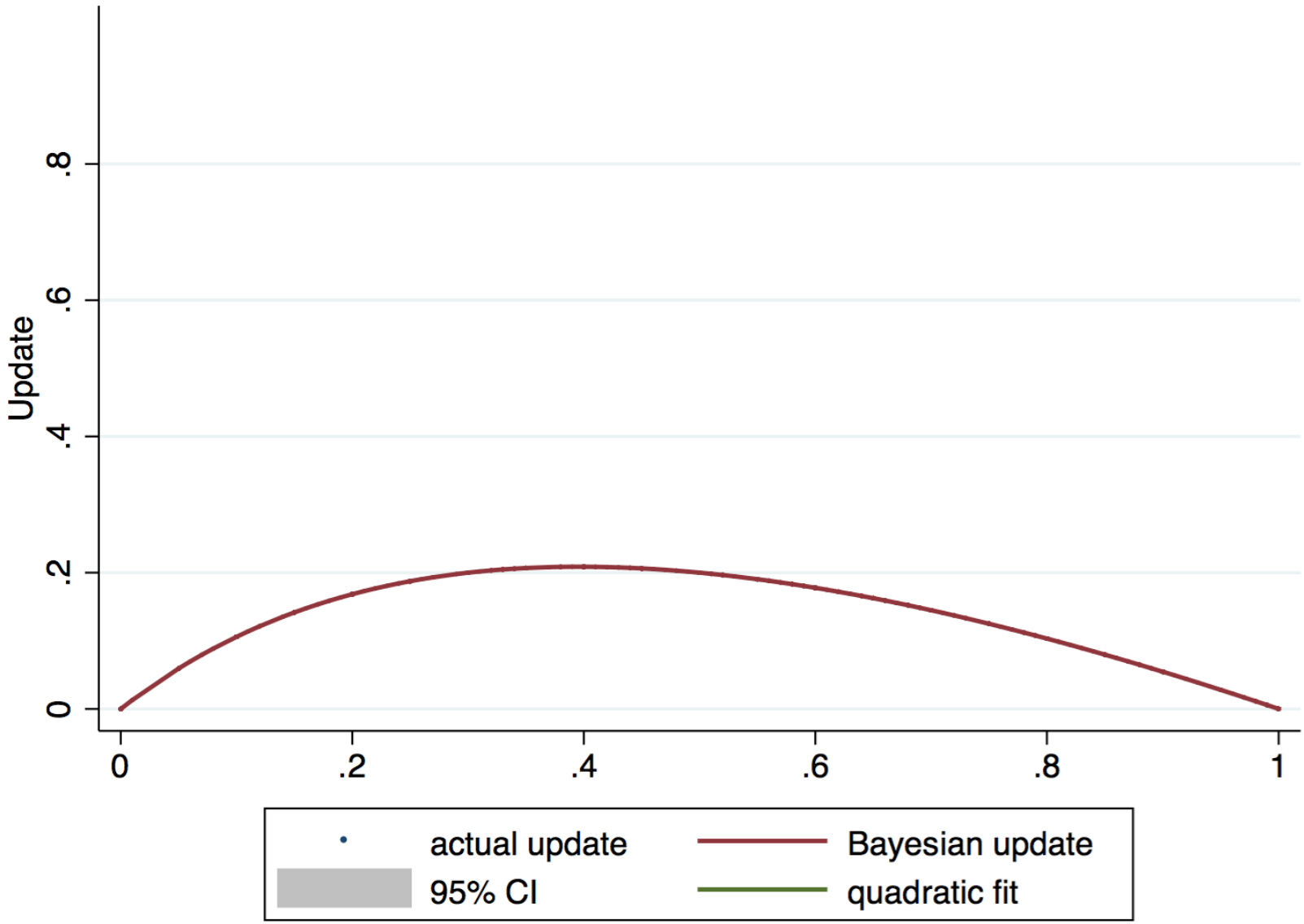


Timeline

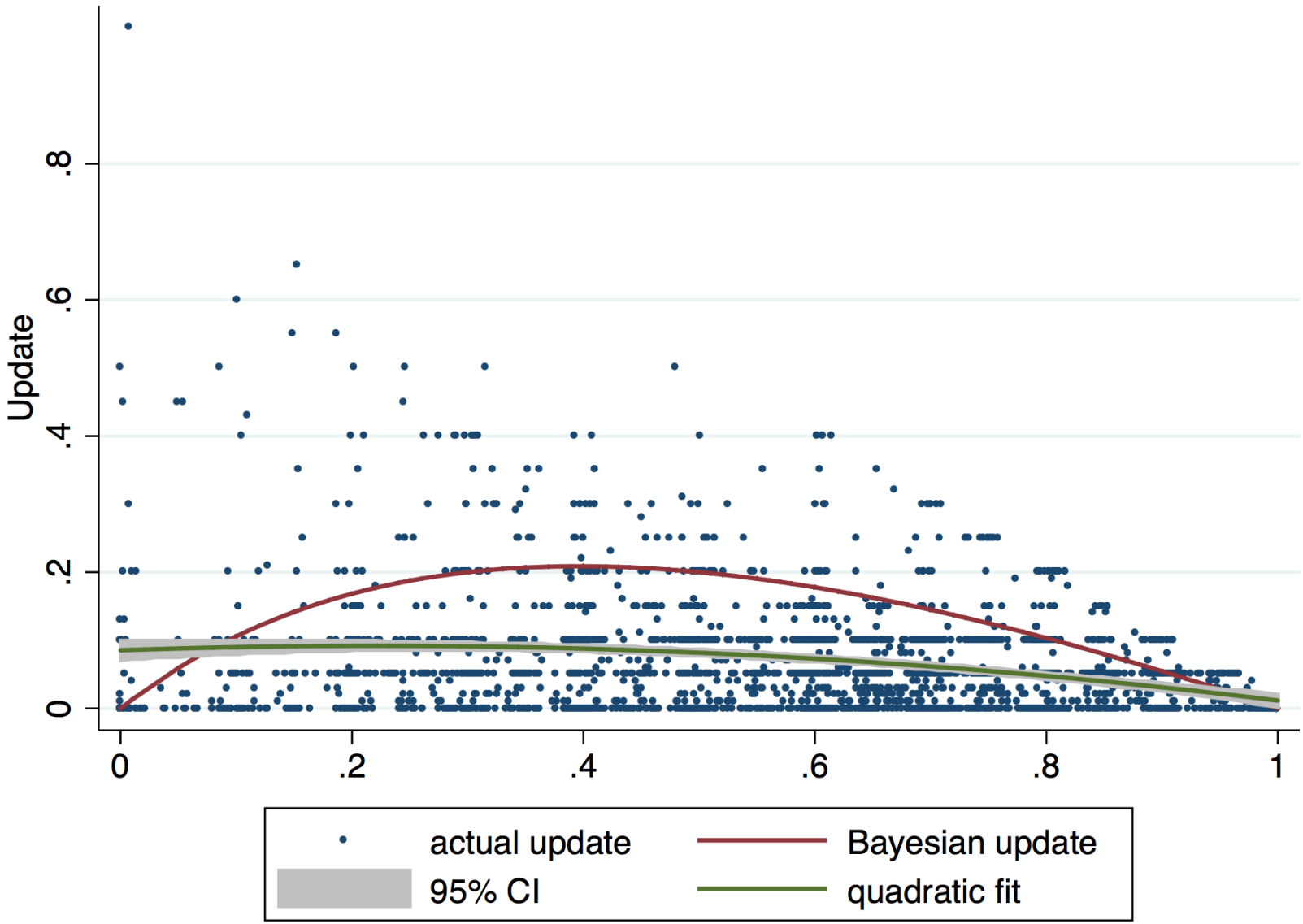
5. Perform second task for 5 minutes + belief elicitation...
6. Perform third task for 5 minutes + belief elicitation...
7. Fourth task: Self-selection into competition.
8. Questionnaire
   - How relevant are the skills tested in tasks ... for success in your field of study?

Aggregate updating

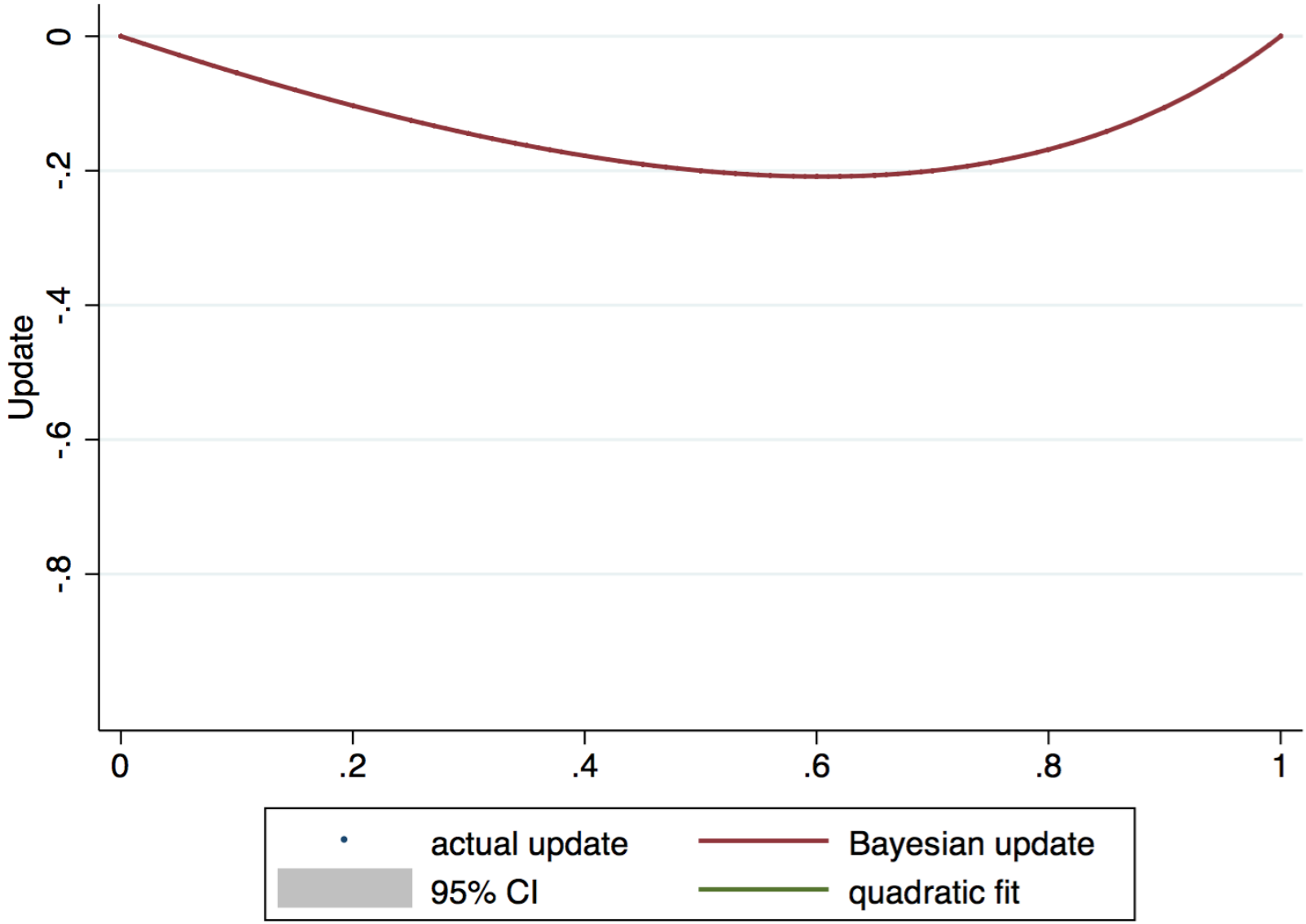
Updates after positive signal



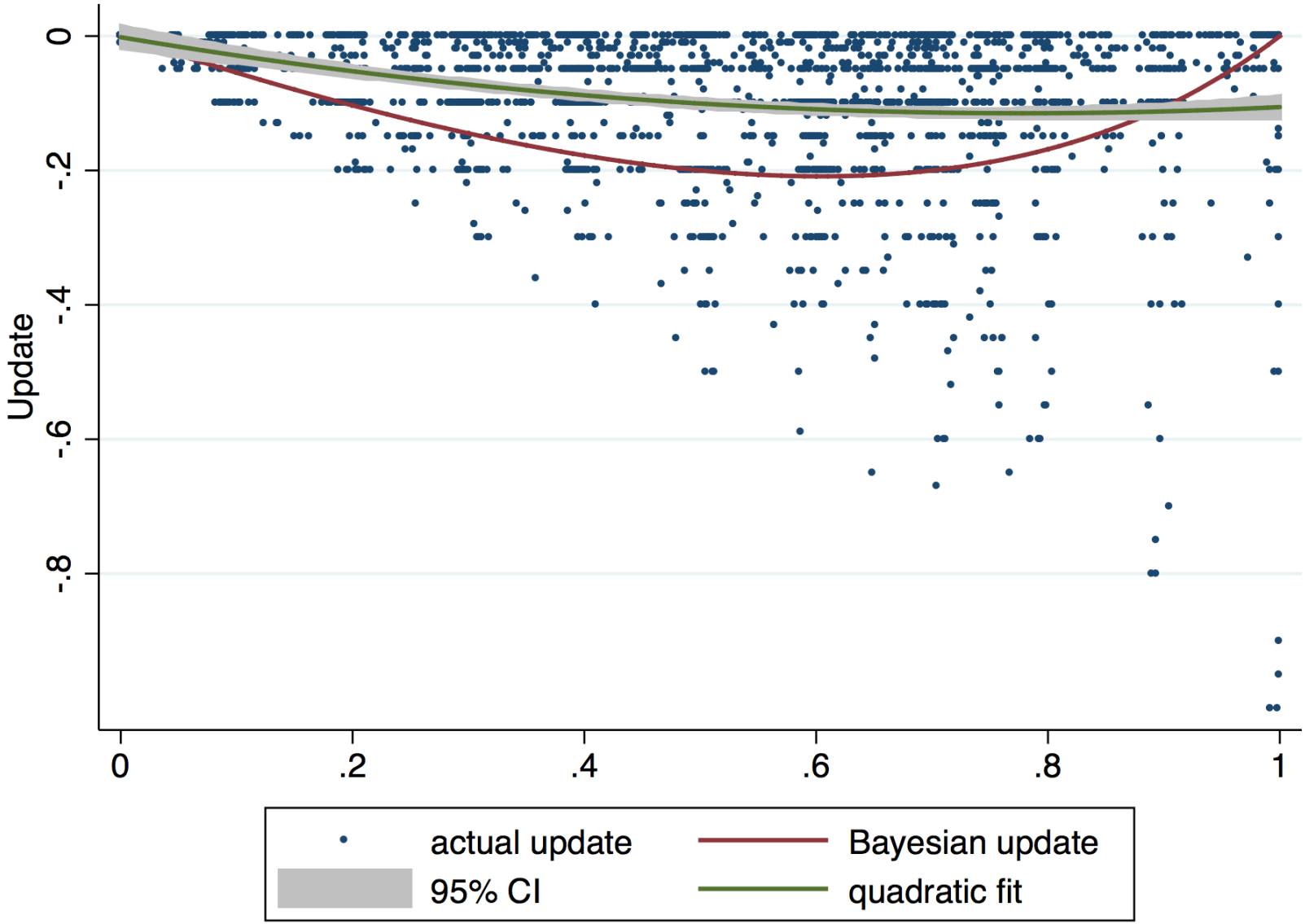
Updates after positive signal



Updates after negative signal



Updates after negative signal



Finding 1 (Aggregate patterns)

Subjects deviate systematically from Bayesian updating:

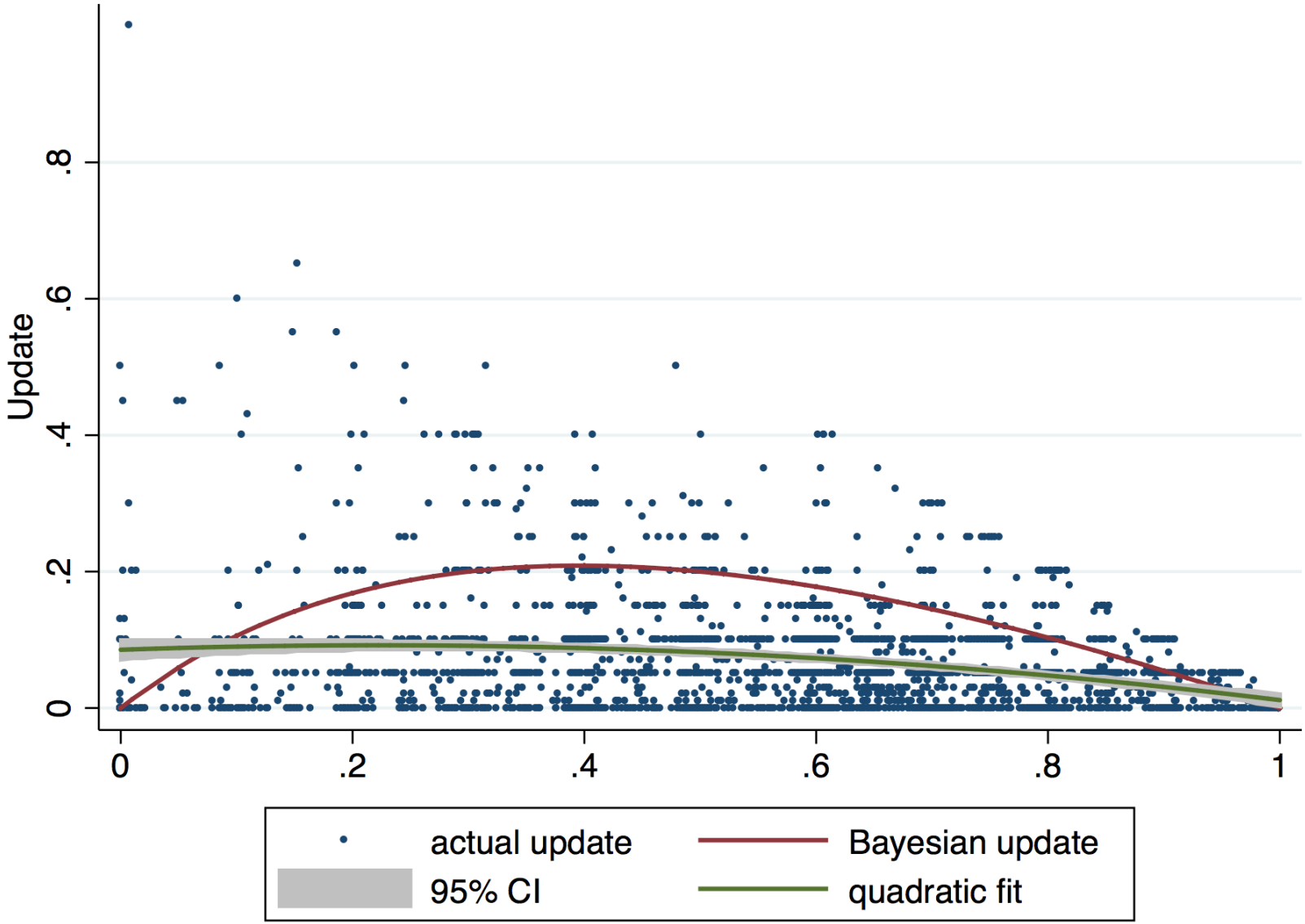
1. *updates are not sufficiently sensitive to the prior belief (even within-subject),*
2. *on average, subjects are too conservative*
3. *no clear evidence for asymmetry*

▸ Initial Beliefs

▸ Wrong updates

▸ Regressions Mobius et al. (2014)

Individual feedback responsiveness


Update
0
.2
.4
.6
.8
0
.2
.4
.6
.8
1
actual update
Bayesian update
95% CI
quadratic fit

Estimate average updating (controlling for prior beliefs).

Relative Asymmetry: update upward more than the average.

Relative Conservatism: update less than the average.

- Compute both task-based (Raven, Anagram, Matrices) and aggregate measures.

▸ Mathematical Definitions

Consistency across domains

Correlations of conservatism and asymmetry measures across tasks

Correlations of conservatism and asymmetry measures across tasks

Conservatism

	C(M)	C(R)
C(A)	0.218***	0.365***
C(M)		0.234**

Correlations of conservatism and asymmetry measures across tasks

Conservatism

	C(M)	C(R)
C(A)	0.218***	0.365***
C(M)		0.234**

Asymmetry

	C(M)	C(R)
C(A)	0.149**	-0.043
C(M)		0.099

Correlations of conservatism and asymmetry measures across tasks

Conservatism

	C(M)	C(R)
C(A)	0.218***	0.365***
C(M)		0.234**

Asymmetry

	C(M)	C(R)
C(A)	0.149**	-0.043
C(M)		0.099

Conservatism correlates over tasks, asymmetry does not.

Ego-relevance and feedback responsiveness

Ego-relevance and gender effects

	(1) A	(2) C	(3) A	(4) C	(5) A	(6) C
Female	-0.108	0.183**	-0.060	0.179**	-0.048	0.181**
	(0.077)	(0.085)	(0.073)	(0.084)	(0.073)	(0.084)
Relevance	0.023	0.040*	0.009	0.041*	0.002	0.039*
	(0.022)	(0.022)	(0.021)	(0.022)	(0.021)	(0.022)
Scores & ranks			✓	✓	✓	✓
Initial beliefs					✓	✓
Relevance	0.026	0.039*	0.017	0.036	0.021	0.039*
	(0.028)	(0.022)	(0.026)	(0.023)	(0.026)	(0.023)
Scores & ranks			✓	✓	✓	✓
Initial beliefs					✓	✓
Individual fixed effects	✓	✓	✓	✓	✓	✓
N	798	798	798	798	798	798

Table 4: OLS regressions of individual asymmetry (Asym.) and conservatism (Cons.) on task relevance and gender. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at the individual level. Each person-task combination is one observation. Regressions with asymmetry as the outcome additionally control for conservatism and vice versa.

Predictive power of feedback responsiveness

Competition entry

Study self-selection into competition.

(Niederle and Vesterlund 2007)

Perform 4th task, consisting of mix of three previous tasks. Choose reward scheme

- Piece rate (12DKK per point)
- Competition (24DKK per point if they outperform random opponent, nothing otherwise)

Questions:

1. Can feedback responsiveness explain the choice to enter into competition?
2. Do these effects operate through final beliefs or separate channels?

Competition Choice

	(1)	(2)	(3)	(4)	(5)
Female	-0.121**	-0.113**	-0.070	-0.088*	-0.082*
	(0.048)	(0.048)	(0.046)	(0.045)	(0.046)
Asymmetry	0.079***	0.105***	0.066***	0.023	0.044
	(0.025)	(0.029)	(0.024)	(0.025)	(0.032)
Conservatism	0.053**	0.221***	0.045*	0.048**	0.134*
	(0.024)	(0.076)	(0.023)	(0.022)	(0.075)
Conservatism x #signals		-0.018**			-0.009
		(0.008)			(0.008)
#signals		0.024*			0.006
		(0.013)			(0.013)
Scores and ranks	✓	✓	✓	✓	✓
Initial beliefs			✓	✓	✓
Final beliefs				✓	✓
N	297	297	297	297	297

Table 5: Probit regressions of competition entry on measures of feedback responsiveness. Marginal effects reported. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

▸ Cost of asymmetry/conservatism

Main findings

Aggregate bias:

- Relative to a Bayesian benchmark, people are on average conservative and not responsive to priors.

Fingerprint:

- Relative conservatism (but not asymmetry) is systematically correlated across tasks.
- Subjects are more conservative, but not more asymmetric in tasks that they consider more ego relevant.

Predictive power:

- Asymmetry increases entry through higher beliefs.
- Conservatism affects entry both through beliefs and independently.

Conclusions

Replication: Existence of asymmetric updating in ego relevance still an open question.

Individual measures: Updating fingerprint?

- Consistent "trait" of conservatism
- Both asymmetry and conservatism predict competition entry, which predicts choices outside the lab

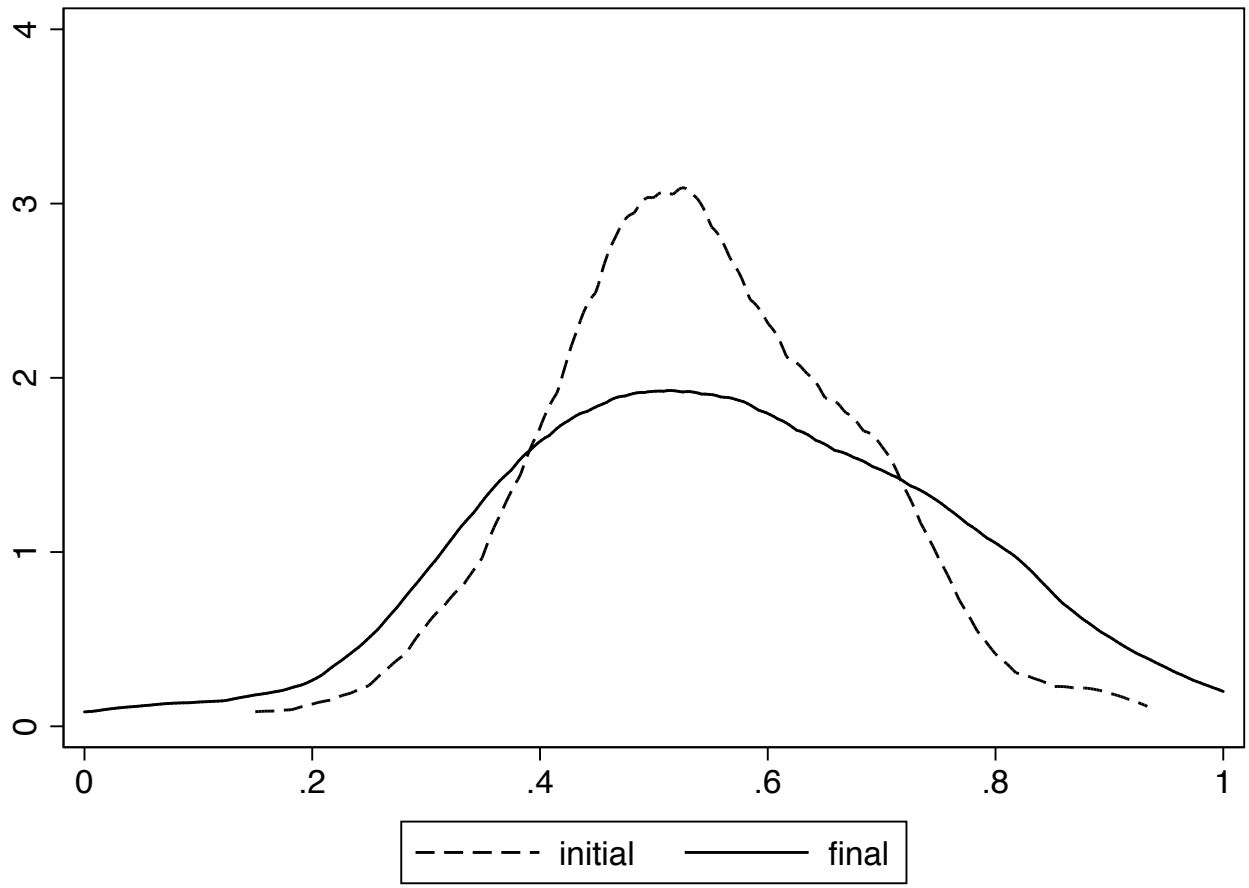
  Buser et al. 2014, Reuben et al., 2015, Zhang 2013

But:

- No correlations for asymmetry
- Elicitation is time consuming

Thank you!

Initial Beliefs



- Subjects are slightly overconfident (average belief is 55%)
- Beliefs more spread out and more accurate over time

Initial Beliefs

	(1)	(2)	(3)	(4)
Female	-0.050***	-0.030**		
	(0.015)	(0.014)		
Relevance	0.029***	0.021***	0.031***	0.023***
	(0.004)	(0.004)	(0.005)	(0.004)
Scores & ranks		✓		✓
Individual fixed effects			✓	✓
N	891	891	891	891

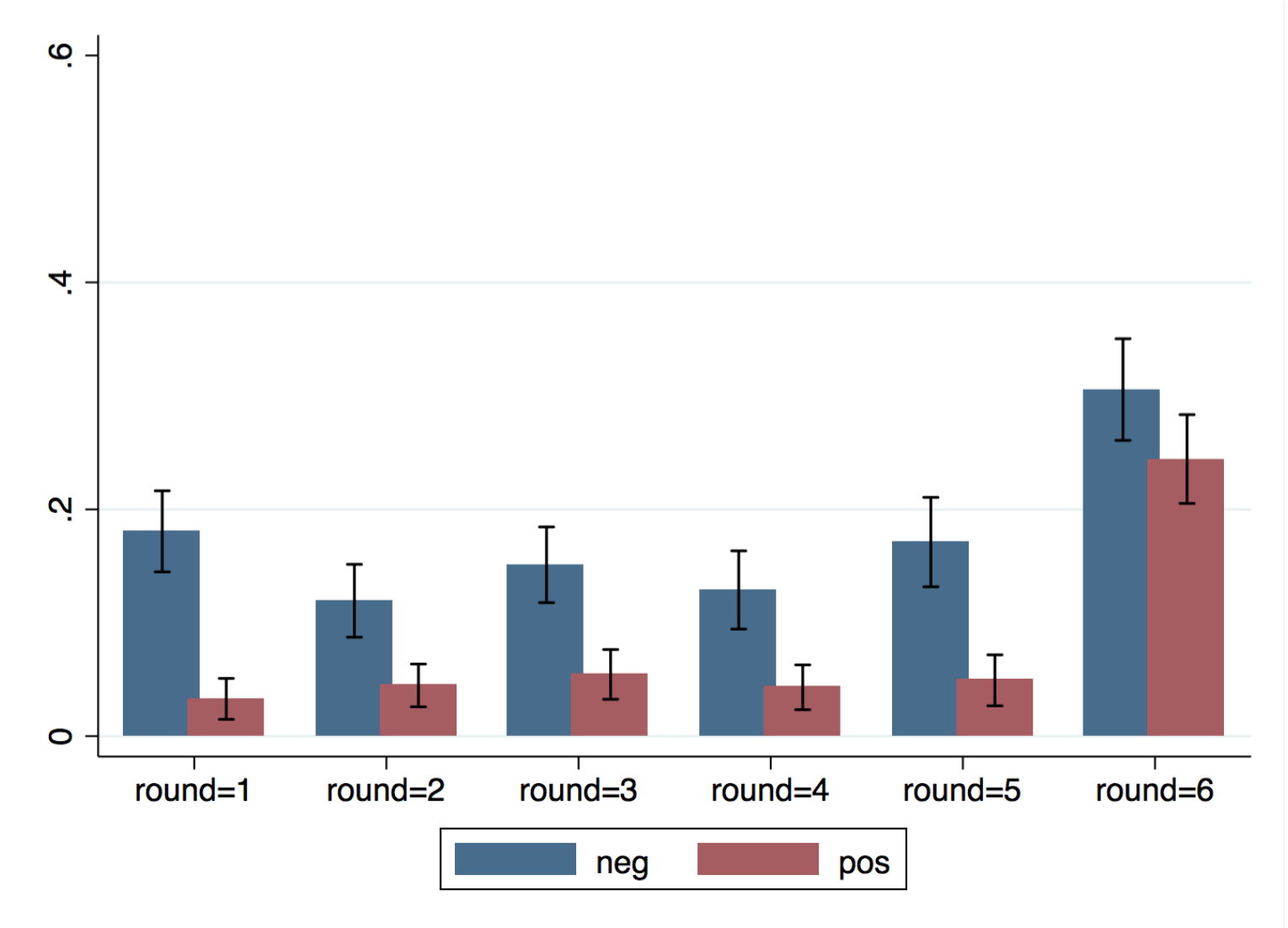
Table 3: OLS regressions of initial beliefs on task relevance and gender. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at the individual level.

- Women are less confident initially
- "Relevance" of task raises initial confidence within-subject (cannot be explained by superior study background).

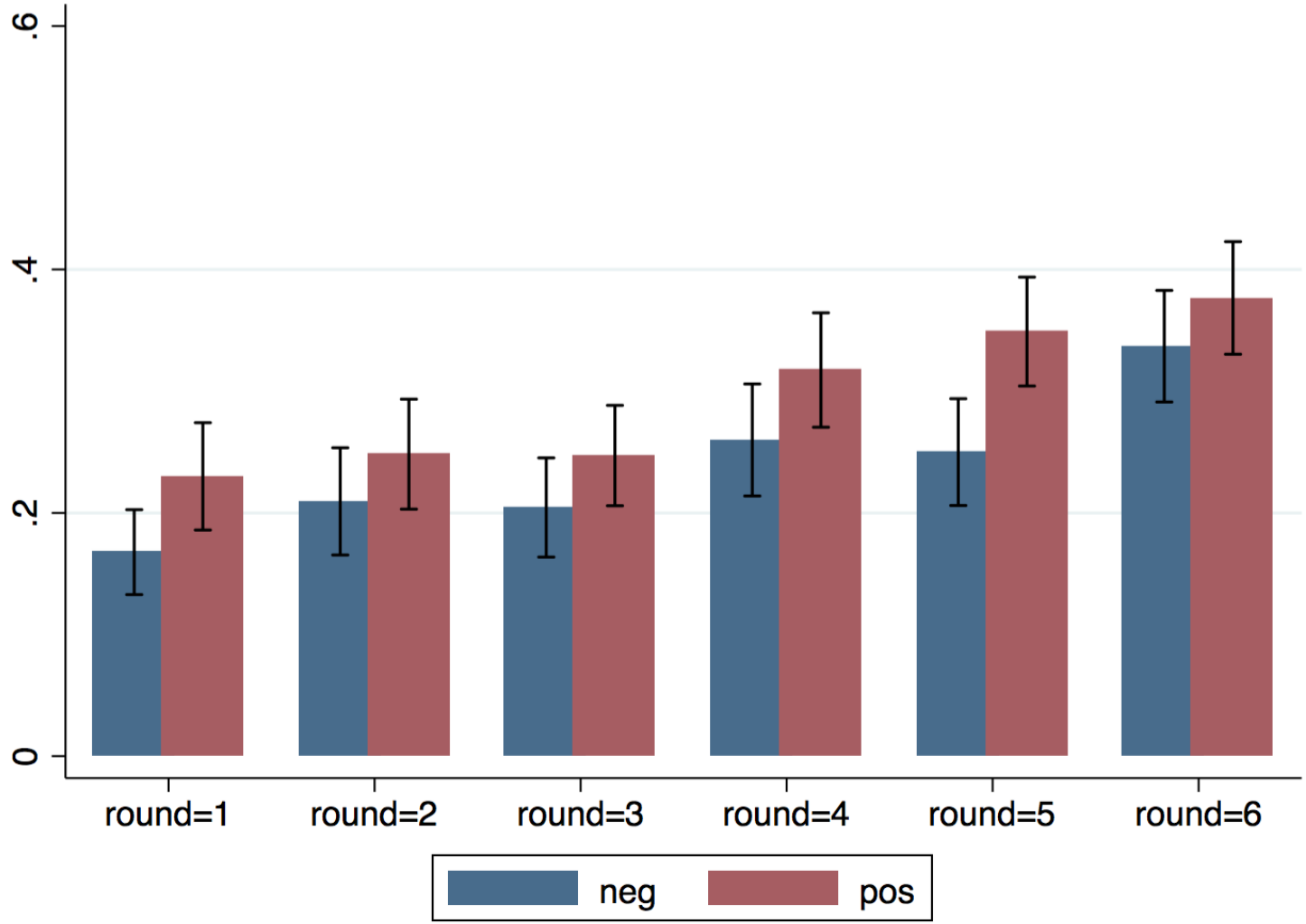
  (see also Grossman and Owens 2012)

Back

Updates in the wrong direction



Zero updates



Back

Logit regression of Bayes' rule

Bayes' rule can be linearized in terms of log-odds, and estimated as

$$\mu_{i,post} = \delta\mu_{i,prior} + \beta_H I_{\{s_i=H\}}\lambda_H + \beta_L I_{\{s_i=L\}}\lambda_L + \varepsilon_i,$$

where

- $\mu_{i,post}$ is the log odds ratio of the posterior probability of i,
- $\mu_{i,prior}$ is the log odds ratio of the prior probability of i, and
- $\lambda_H = -\lambda_L$ is the log likelihood ratio of the signal.

Bayesian updating implies $\delta = 1$ and $\beta_L = \beta_H = 1$.

Logit regression of Bayes' rule

One can define the following biases (see also Möbius et al. 2014)

- $\beta_L, \beta_H < 1$ implies **"conservatism"**: the update is less than it should be.

- $\beta_L < \beta_H$ implies **"asymmetry"**: positive signals are weighted more heavily.

Möbius et al regressions

	(1)	(2)	(3)
Logit prior	0.860***	0.951***	0.948***
	(0.017)	(0.010)	(0.013)
Signal high	0.358***	0.404***	0.476***
	(0.018)	(0.022)	(0.020)
Signal low	0.254***	0.398***	0.464***
	(0.017)	(0.020)	(0.019)
P (Prior=1)	0.000	0.000	0.000
P (Asymmetry)	0.000	0.759	0.583
No boundary priors in task	✓	✓	✓
No wrong updates in task		✓	✓
Only rounds 1-4			✓
Observations	4507	2197	2375
Subjects	288	218	272

▸ Back

Definition of measures

Average prior estimate:

$$\Delta\mu_{int} = \alpha + \beta_1\mu_{in,t-1} + \beta_2\mu^2_{in,t-1} + \gamma_1 1_1 + ... + \gamma_{10} 1_{10} + \varepsilon_{int}$$

where

- $\Delta\mu_{int} := \mu_{int} - \mu_{in,t-1}$ is the update by individual i in round t and task n
- and $1_1, 1_2 ... 1_{10}$ represent dummies indicating that $0 \leq \mu_{in,t-1} < 0.1, ..., 0.9 \leq \mu_{in,t-1} \leq 1$

Asymmetry

Relative Asymmetry: Stronger updates after positive rather than negative feedback compared to the average person.

- Individual asymmetry in task n is then defined as

$$A_{in} := \frac{1}{N_{in}^{-}} \sum_{t=1}^{6} 1_{(s_{int}=L)} * \varepsilon_{int} + \frac{1}{N_{in}^{+}} \sum_{t=1}^{6} 1_{(s_{int}=H)} * \varepsilon_{int} \qquad (1)$$

  where ε_{int} denotes the regression residuals. A_{in} is the sum of the average residual after a positive and the average residual after a negative signal.

- A_{in} is positive, if an individual updates upward more than the average person.

Conservatism

Relative Conservatism: Smaller updates then the average person.

- Conservatism is defined as

$$C_{in} := \frac{1}{N_{in}^{-}} \sum_{t=1}^{6} 1_{(s_{int}=L)} * \varepsilon_{int} - \frac{1}{N_{in}^{+}} \sum_{t=1}^{6} 1_{(s_{int}=H)} * \varepsilon_{int} \qquad (2)$$

  C_{in} is the average residual after a negative signal minus the average residual after a positive update.

- C_{in} is positive, if an individual updates upward less than the average person after a positive signal and updates downward less than average after a negative signal.

Back

The cost of asymmetry and conservatism

How do payoffs change with relative conservatism and asymmetry?

	(1)	(3)	(4)	(6)
		all	mean initial	belief>0.5
Female	-1.644	-2.868**	-2.433	-3.695*
	(1.081)	(1.289)	(1.671)	(2.027)
Asymmetry	1.238**	-3.198**	1.210	-1.972
	(0.583)	(1.516)	(0.932)	(2.522)
Conservatism	0.949*	-0.912	2.265***	-1.838
	(0.542)	(1.563)	(0.789)	(2.960)
Conservatism x mean rank		2.141		4.782
		(3.733)		(6.303)
Asymmetry x mean rank		7.510**		4.506
		(3.691)		(5.362)
Mean rank		37.099***		44.480***
		(3.561)		(5.316)
Scores and ranks	✓		✓	
N	297	297	171	171

Table 6: OLS regressions of expected earnings in task 4 on asymmetry and conservatism. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at the individual level.

Back

The costs of conservatism and asymmetry

Finding 2 (Cost/benefit)

Relative asymmetry and conservatism are beneficial on average, indicating that people "undercompete".

For high (and confident) performers asymmetry is profitable as it raises competition entry.

By contrast, asymmetry and conservatism are detrimental to low performers, who are better off not participating.