How Much Can I Make? Insights on Belief Updating in the Labor Market

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Motivating Example

- Suppose there are two workers: Al and Bob, both thinking about how much they could earn if they were to look for a new job
- Al thinks he can get \$100,000
- Bob thinks he can get \$200,000
- True average of offers is \$100,000
- Both initially get offer of \$100,000, only Al accepts
- Bob goes on to get offers of \$90,000 and \$110,000
- Can Bob learn the true distribution?

Studying Updating in the Labor Market

- While there has been some recent work done on the level of labor market beliefs, in this paper we instead investigate belief learning
- Implications information intervention efficacy
- Literature uses whether beliefs follow Bayes rule to judge whether belief updating is "too much" or "too little"

Bayes Rule in the Labor Market Belief Context

- True wage distribution, F, centered at unknown value θ
- Beliefs g over θ at time t
- Signal x (e.g. wage offer)
- According to Bayes rule, she should change to the belief

$$g_{t+1}^{bayes}(\theta|x_t) = \frac{\overbrace{g_t(\theta)}^{\text{prior}}\overbrace{p(x_t|\theta)}^{\text{signal}}}{\underbrace{\int_{\theta' \in \Theta} g_t(\theta')p(x_t|\theta')}_{\text{normalizing factor}}}$$

- Difficult to calculate outside lab; requires strong assumptions

Applying New Methods

- New method introduced in Augenblick & Rabin 2021 avoids the issue of constructing Bayesian benchmark
- Test for Martingale property that only requires measuring beliefs
- Let the state space be Θ and set of signals X
- **Martingale Property:** $\mathbb{E}_X(g_{t+1}(\theta|x)|g_t(\theta)) = g_t(\theta)$
- Idea: Before you observe the signal, you should not expect your beliefs to change
- Under the assumption of correct beliefs, Bayesian updating implies the Martingale property

Test Details

- 2 states and state 1 occurs with probability π
- Belief movement

$$m_{t_1,t_2} \equiv \sum_{\tau=t_1}^{t_2-1} (\pi_{\tau+1} - \pi_\tau)^2$$

- Uncertainty Reduction

$$\begin{aligned} r_{t_1,t_2} &\equiv \sum_{\tau=t_1}^{t_2-1} \pi_\tau(1-\pi_\tau) - \pi_{\tau+1}(1-\pi_{\tau+1}) \\ &= \pi_{t_1}(1-\pi_{t_1}) - \pi_{t_2}(1-\pi_{t_2}) \end{aligned}$$

- If the Martingale property holds, the two statistics should be the same on average for the population
- Idea: Information that changes your beliefs should also make you more sure about your beliefs

Best Offer Estimate: SCE Question text

OO2a2 - OO2a2 (Added March 2015)

Think about the job offers that you may receive within the coming four months. Roughly speaking, what do you think the annual salary for the best offer will be for the first year?

Note the best offer is the offer you would be most likely to accept.

____________________________ dollars

Best Offer Estimate: SCE Question text

OO2b - OO2b (shown if OO2a2 > 0 each response is % of OO2a2 ranging from .8 to 1.2) **(Added November 2014)**

Think again about the job offers that you may receive within the coming four months. What do you think is the percent chance that the job with the best offer will have an annual salary for the first year of...

The best offer is the offer you would be most likely to accept.

Less than [0.8* OO2a2] dollars (1)	________________	% (1)
Between [0.8* OO2a2] dollars and [0.9* OO2a2] dollars (2)	________________	% (2)
Between [0.9* OO2a2] dollars and [1.0* OO2a2] dollars (3)	________________	% (3)
Between [1.0* OO2a2] dollars and [1.1* OO2a2] dollars (4)	________________	% (4)
Between [1.1* OO2a2] dollars and [1.2* OO2a2] dollars (5)	________________	% (5)
More than [1.2* OO2a2] dollars (6)	________________	% (6)

Test Results

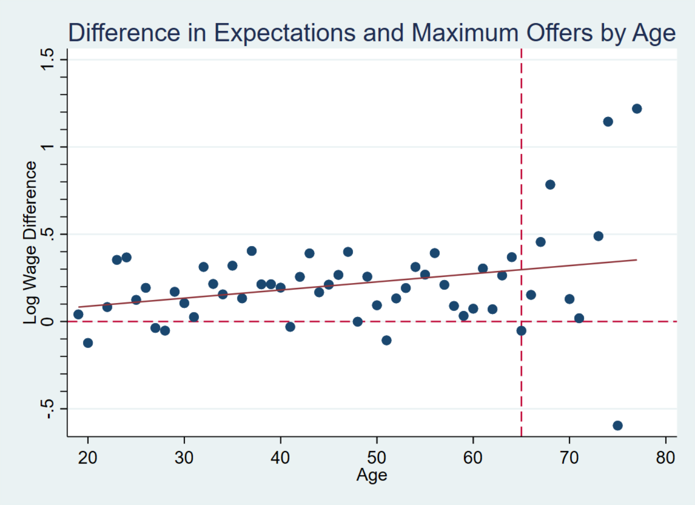
Statistic	All Individuals	Got Offer?		Searched?	
		Yes	No	Yes	No
$\overline{m}$	.9341	1.0499	.9011	1.0083	.9004
	(.0193)	(.0434)	(.0213)	(.0372)	(.0213)
$\overline{r}$	.1805	.1981	.1755	.1989	.1687
	(.0079)	(.0190)	(.0085)	(.0134)	(.0080)
X	.7536	.8518	.7256	.8094	.7317
	(.0207)	(.0472)	(.0248)	(.0358)	(.0224)
X_{norm}	5.1751	5.2998	5.1345	5.0694	5.3373
Observations	2489	552	1937	691	1613

Table: Excess movement statistics: Log normal-fitted results. Standard errors in parentheses.

Interpretation

- Large excess belief movement (EM $>$ ER)
- Implies people over-updating
- Our robustness checks suggest this is not due to measurement error
- Possible interpretations:
  1. Overreaction (too much weight placed on signal)
  2. Base rate neglect (too little weight placed on prior beliefs)
  3. Incorrect prior beliefs
- Main observable difference between 1 and 2: Long-run belief convergence

Base Rate Neglect: Prediction Error by Respondent Age



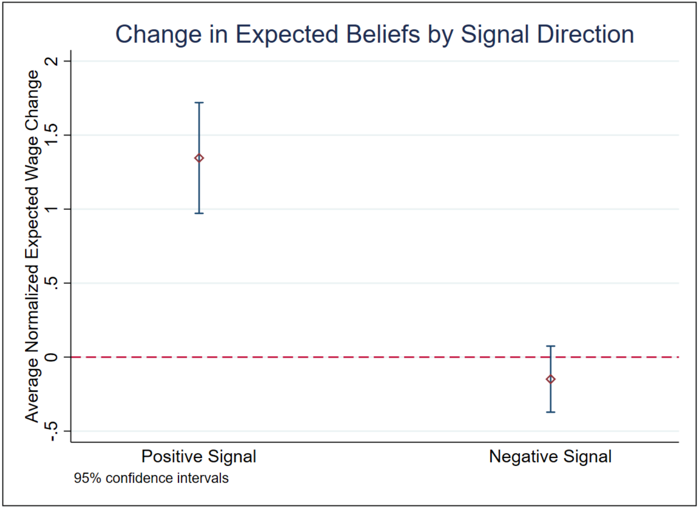
Direction and Normalization Definitions

- The difference between beliefs and realized offers positive overall. Why might this be?
- Define $\overline{x}_t$ as the average wage offer reported in period t's survey and $\hat{x}_t$ as the expected average wage elicited period t survey
- Normalized Difference in Expectations:

$$\frac{\hat{x}_2 - \hat{x}_1}{|\overline{x}_2 - \hat{x}_1|}$$

- Signal Direction:
  1. Positive Signal: $\overline{x}_2 > \hat{x}_1$
  2. Negative Signal: $\overline{x}_2 < \hat{x}_1$

Asymmetric Updating: Normalized Differences



Conclusion

- We use a recently-developed statistical test from Augenblick & Rabin (2021) to study belief updating in a labor market setting with survey data
- We found large excess movement (information provision is likely to move beliefs, at least in short-run)
- Suggestive evidence for base-rate neglect
- Evidence of asymmetric updating where people update more when they receive a positive signal