

State-Dependent Sticky Expectations: Evidence and Theory

Kenneth Eva

University of
Pennsylvania

Michael Lamla

University of
Duisburg-Essen

Damjan Pfajfar

Federal Reserve
Bank of Cleveland

Midwest Macro, Cleveland

November 14, 2025

Background and Research Question

“Once consumers took notice of rising inflation, their inflation perceptions responded quickly but reduced more sluggishly when inflation started to fall.”

–Christine Lagarde, ECB’s President, March 12, 2025

During the recent inflationary episode

- Professional outlook on future inflation was dispersed
- Households’ expectations rose with current inflation, stayed high

Research question: How do households process uncertainty around inflation outlook when forming their expectations?

This Paper

In surveys of U.S. and German households, we

- Conduct an RCT with different information treatments about future inflation
- Provide causal evidence that perceived uncertainty dampens updating

We develop a model to

- Incorporate an updating mechanism to match RCT evidence
- Study implications for persistence of inflation expectations

Preview of Results

We document two new stylized facts about updating inflation expectations

1. Households react more to information with higher levels of precision
→ Different response only in the extensive margin
2. The extensive margin response to inflation news is asymmetric
→ More frequently update when signal is above prior

Develop a model where households are rationally inattentive to future inflation

In times of high uncertainty elevated inflation expectations may persist

- Increased information processing costs of uncertain inflation signals
- Losses are relatively smaller during disinflation process

Related Literature

RCT Experiments

- Haldane and McMahon (2018); Coibion et al. (2021); Coibion, Gorodnichenko, and Weber (2022); Dräger, Lamla, and Pfajfar (2022); Coibion et al. (2023)

Models of Expectation Formation

- Branch (2004); Pfajfar and Santoro (2010); Coibion and Gorodnichenko (2012, 2015); Malmendier and Nagel (2016); D'Acunto et al. (2021)
- Woodford (2008, 2009), Morales-Jimenez and Stevens (2025)

Role of Macroeconomic Uncertainty

- Coibion, Georgarakos, Gorodnichenko, Kenny, and Weber (2024); Coibion, Gorodnichenko and Kumar (2023)

Outline

RCT Experiment

Empirical Results

Model

Conclusion

Appendix

RCT Experiment

Empirical Approach

We ran two surveys in

- December 2022 covering 3000 U.S. households
- August 2023 covering 3800 German households (BOP-HH)

Both surveys contain a randomized control trial (RCT):

1. Elicit prior inflation expectations
2. Give a piece of news about inflation to randomly allocated subgroups
3. Elicit posterior inflation expectations
4. Followup questions [▶ Details](#)

Treatment Arms

5 treatments:

1. No additional news (“No Treatment”)
2. 2022:Q4 SPF mean forecast for CPI inflation (“Mean Only”)
3. Mean + range of responses (“Large Band”)
4. Mean + 20th and 80th percentile responses (“Small Band”)
5. US population growth over the last 3 years (“Placebo”)

► Details

Empirical Results

Empirical Strategy: Treatment Margins

Overall Margin

$$\pi_{i,post}^e = \alpha_0 + \alpha_1 \pi_{i,prior}^e + \beta'_1 T_i + \beta'_2 T_i \times \pi_{i,prior}^e + \gamma' X_i^c + u_i$$

Extensive Margin

$$1\{\Delta \pi_i^e \neq 0\} = \alpha_0 + \alpha_1 \pi_{i,prior}^e + \beta'_1 T_i + \beta'_2 T_i \times \pi_{i,prior}^e + \gamma' X_i^c + u_i$$

Intensive Margin

$$\pi_{i,post|revised}^e = \alpha_0 + \alpha_1 \pi_{i,prior}^e + \beta'_1 T_i + \beta'_2 T_i \times \pi_{i,prior}^e + \gamma' X_i^c + u_i$$

Estimate using population and Huber robust weights

Results: Treatment Margins

	Overall Margin		Extensive Margin		Intensive Margin	
π_{prior}^e	0.7299*** (0.0159)	0.9846*** (0.0063)	-0.0003 (0.0022)	-0.0140*** (0.0039)	0.2149*** (0.0139)	0.4559*** (0.0701)
Mean Only	-1.8307*** (0.1823)	1.1757*** (0.1878)	0.4641*** (0.0371)	0.3075*** (0.0685)	0.1968 (0.2765)	1.2801*** (0.4029)
Large Band	-1.2101*** (0.1796)	0.1210 (0.1192)	0.2582*** (0.0372)	0.0721 (0.0678)	0.2030 (0.2984)	1.8714*** (0.4306)
Small Band	-1.6819*** (0.1883)	1.7791*** (0.2227)	0.4646*** (0.0370)	0.2887*** (0.0671)	0.3671 (0.2734)	1.6181*** (0.3984)
Placebo	-0.3457** (0.1645)	-0.1745* (0.1028)	0.1171*** (0.0335)	0.0746 (0.0639)	-0.7907** (0.3309)	-0.4253 (0.4629)
Mean Only $\times \pi_{prior}^e$		-0.3659*** (0.0367)		0.0194*** (0.0063)		-0.2456*** (0.0740)
L. Band $\times \pi_{prior}^e$		-0.0324** (0.0139)		0.0223*** (0.0063)		-0.3296*** (0.0748)
Sm. Band $\times \pi_{prior}^e$		-0.4827*** (0.0423)		0.0220*** (0.0062)		-0.2681*** (0.0740)
Placebo $\times \pi_{prior}^e$		0.0082 (0.0096)		0.0042 (0.0061)		0.0647 (0.0849)
Constant	2.3644*** (0.6030)	0.1577 (0.2304)	0.0180 (0.0980)	0.1092 (0.1034)	1.4535 (0.9189)	1.0651 (0.9595)
N	1605	1467	1609	1609	727	733
R^2	0.720	0.935	0.182	0.197	0.364	0.414
Mean Only = L. Band	0.002	0.000	0.000	0.001	0.974	0.057
Sm. Band = L. Band	0.023	0.000	0.000	0.003	0.384	0.399
Mean Only = L. Band (int)		0.000		0.682		0.027
Sm. Band = L. Band (int)		0.000		0.960		0.090

Asymmetries in the Extensive Margin

	Overall		Extensive		Intensive	
	Above (1)	Below (2)	Above (3)	Below (4)	Above (5)	Below (6)
$ \pi_t^e _{t-1} - z_t $	0.2631*** (0.0237)	-0.5513*** (0.0600)	0.0200*** (0.0036)	0.1602*** (0.0261)	0.1016*** (0.0194)	-0.5322*** (0.0871)
Large Band	0.6884*** (0.2293)	0.0318 (0.1362)	-0.2365*** (0.0465)	-0.0495 (0.0786)	0.1852 (0.2140)	0.2203 (0.2253)
Small Band	-0.0260 (0.2073)	0.6114*** (0.1674)	-0.0102 (0.0477)	0.0712 (0.0704)	0.0882 (0.1648)	0.9216*** (0.2547)
Constant	3.6919*** (1.0530)	1.7487*** (0.5602)	0.3180* (0.1652)	-0.3313 (0.2399)	3.3323*** (0.5491)	1.4404 (0.9398)
N	723	240	733	244	415	145
R^2	0.195	0.399	0.133	0.261	0.104	0.331

Additional results:

► Considered Bands

► Prior Uncertainty

► Heard News

Model

Environment

Constant nominal wage and interest rate, zero inflation

Unit mass of households who

- Hold assets a and beliefs about the level of future inflation π^e
- Choose probability of updating to correct inflation belief $\Lambda(\pi^e, a)$
- Information cost

$$\theta D(\Lambda || \bar{\Lambda}) = \theta \left[\Lambda \log \left(\frac{\Lambda}{\bar{\Lambda}} \right) + (1 - \Lambda) \log \left(\frac{1 - \Lambda}{1 - \bar{\Lambda}} \right) \right]$$

where $\bar{\Lambda}$ is underlying reference distribution

- Conditional on expectation, choose consumption, labor, and savings

Household's Problem

Household chooses probability of updating Λ to solve

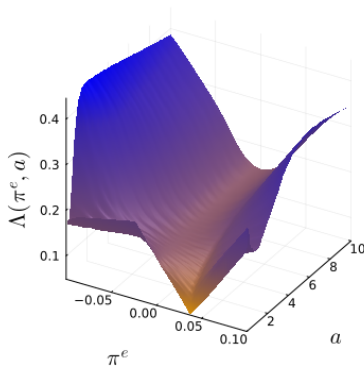
$$V_{\Lambda}(\pi^e, a) = \max_{\Lambda} \{ \Lambda(V(0, a) - \kappa) + (1 - \Lambda)V(\pi^e, a) - \theta D(\Lambda || \bar{\Lambda}) \}$$

where $V(\pi^e, a)$ is value of consuming and saving under belief π^e [► Details](#)

Optimal Λ satisfies

$$\theta \left[\log \left(\frac{\Lambda}{\bar{\Lambda}} \right) - \log \left(\frac{1 - \Lambda}{1 - \bar{\Lambda}} \right) \right] = V(\pi, a) - \kappa - V(\pi^e, a)$$

Optimal Hazard Rate for Updating Expectations



Optimal attention policy: higher likelihood of updating if expectations are too low

Numerical Illustration

Simple partial equilibrium environment

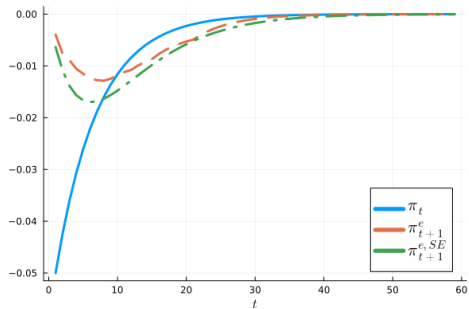
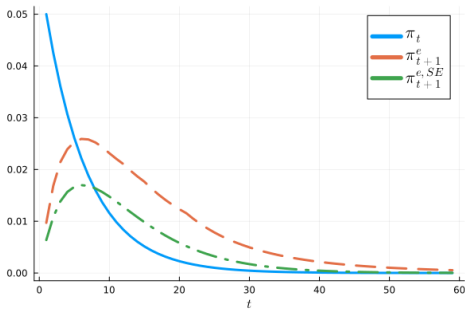
- Inflation follows AR(1) process $\pi_t = \rho\pi_{t-1} + \varepsilon_t$
- Nominal wage w_t set to keep real wage constant
- Nominal interest rate follows Taylor-type rule $i_t = \phi\pi_t$

Track model implied inflation expectations in response to a 5% inflation shock

Compare against benchmark sticky expectations

$$\pi_{t+1}^{e,SE} = \bar{\Lambda}\pi_{t+1} + (1 - \bar{\Lambda})\pi_t^{e,SE}$$

Inflation Dynamics



Pronounced asymmetry in expectations following shocks

- Positive inflationary shocks: fast rise, sluggish fall in expectations
- Negative inflationary shocks: relatively muted response

Conclusion

Conclusion

Uncertainty around forecasts matters for households updating expectations

→ Especially for the decision whether to update expectations

Extensive margin of updating depends on relative position of signal

We propose a model that features these two stylized facts

- Extensive margin is driving force, as in the RCT
- Updating behavior is asymmetric and depends on distance from signal

Partial equilibrium exercise shows this can help explain the last mile effect

Appendix

Appendix: Treatments

Your previous inflation expectation was $[\pi_{i,prior}^e]$.

Would you like to adjust your expectations base on the following information?

- ... [Mean Only] According to a mean response in the Survey of Professional Forecasters, inflation over the next 12 months will be 3.7 percent.
- ... [Large Band] According to a mean response in the Survey of Professional Forecasters, inflation over the next 12 months will be 3.7 percent, where the range of responses was between 1.7 percent and 7.1 percent.
- ... [Small Band] According to a mean response in the Survey of Professional Forecasters, inflation over the next 12 months will be 3.7 percent, where most responses fell between 2.9 percent and 4.8 percent.
- ... [Placebo] The U.S. population grew 1.2 percent over the last three years.

Appendix: Additional Information

Control for large set of socioeconomic characteristics

- Age, sex, income, education, financial literacy, etc.

Collect information on

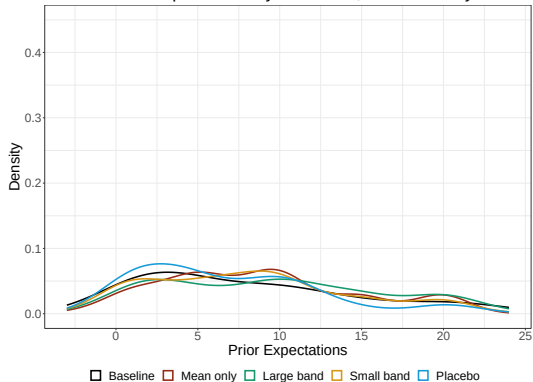
- News received about inflation
- Certainty of prior forecast
- Use of information in decisionmaking (e.g. whether information was useful or in line with own projection and whether people consciously incorporate the bands in their decisionmaking)

Appendix: Demographics

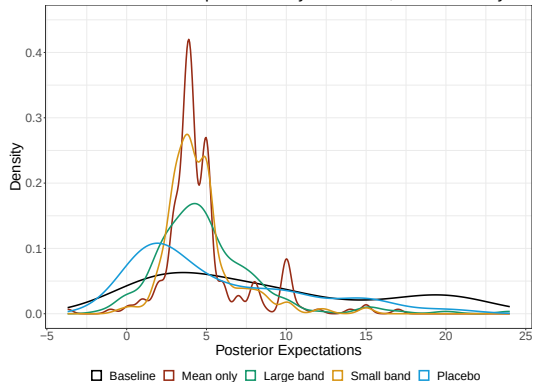
	Female	Over 54	Mid. inc.	High inc.	High school	Voc.	Uni.
No information	0.55	0.19	0.28	0.09	0.35	0.14	0.49
Mean only	0.57	0.19	0.26	0.11	0.34	0.16	0.48
Large Band	0.57	0.16	0.24	0.11	0.35	0.18	0.45
Small Band	0.54	0.19	0.28	0.11	0.33	0.19	0.48
Placebo	0.56	0.17	0.27	0.10	0.27	0.19	0.53
Average	0.56	0.18	0.27	0.10	0.33	0.17	0.49

Appendix: Prior and Posterior Kernel Densities

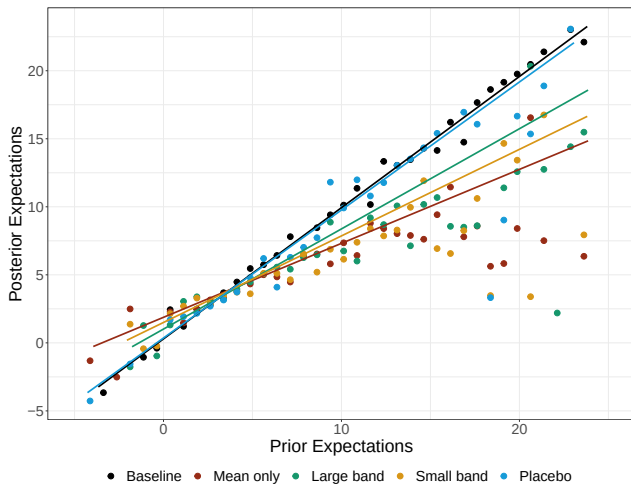
Prior Inflation Expectations by Treatment, Revisers Only



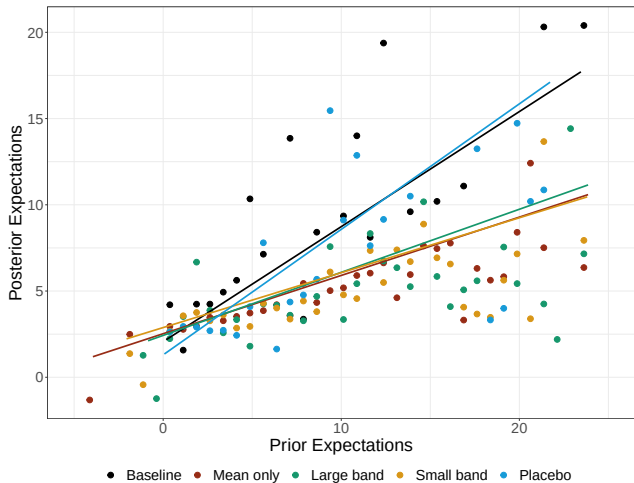
Posterior Inflation Expectations by Treatment, Revisers Only



Appendix: Overall Margin Scatterplot



Appendix: Intensive Margin Scatterplot



Appendix: Intensive Margin Kernel Densities

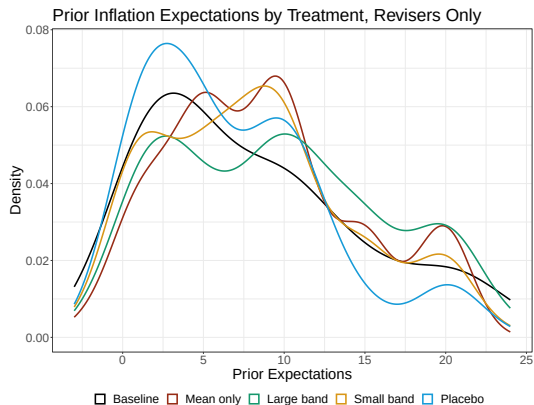


Figure: Prior belief kernel density

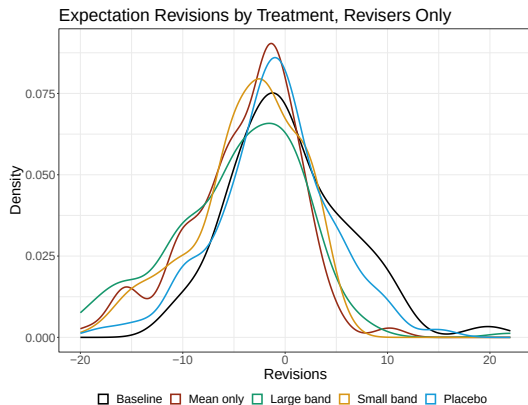
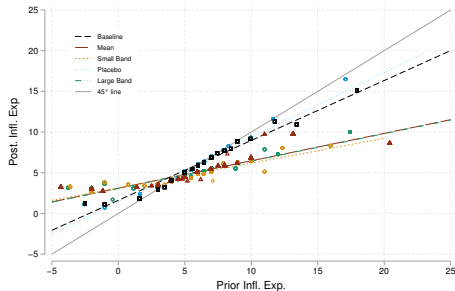
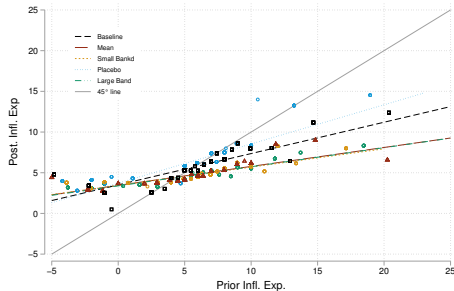


Figure: Posterior belief kernel density

Appendix: BOP-HH Scatterplot



Overall



Intensive margin

► Back

Appendix: Conscious Bands

	Overall	Extensive	Intensive
Large Band	0.5386* (0.3252)	-0.0716 (0.0604)	0.5183 (0.3595)
Considered Band	-0.1249 (0.2637)	0.4043*** (0.0578)	0.1643 (0.2278)
L. Band $\times$ Considered Band	-0.7235* (0.3829)	-0.1467* (0.0797)	-0.5632 (0.4113)
N	628	658	340
R^2	0.065	0.203	0.097

Appendix: Variance of Prior Expectation

	Population Weights	Huber Weights
π_{prior}^e	-0.000 (-0.14)	0.006** (3.02)
Prior uncertainty	0.070 (1.24)	0.221*** (5.26)
Mean Only	0.388*** (8.50)	0.523*** (14.96)
Large Band	0.213*** (4.78)	0.362*** (10.47)
Small Band	0.385*** (8.52)	0.510*** (14.89)
Placebo	0.087* (1.98)	0.191*** (5.51)

Appendix: News Regressions

	$\pi_{i,prior}^e$		
	News	Pos. News	Neg. News
$\pi_{i,prior}^e$	0.5999*** (0.0399)	0.6517*** (0.0243)	0.5586*** (0.0373)
$\pi_{i,prior}^e \text{ news}$	0.0365 (0.0493)	-0.1709** (0.0762)	0.1135** (0.0478)
1.Mean only	-3.3011*** (0.4903)	-2.3008*** (0.2697)	-2.7462*** (0.3961)
1.news	-1.0750** (0.5475)	0.6859 (0.7572)	-1.3113*** (0.5035)
1.Mean only#1.news	1.4162** (0.5669)	0.6297 (0.7432)	0.8604* (0.5075)
1.High variance	-2.3844*** (0.5332)	-1.5819*** (0.2784)	-2.2072*** (0.5232)
1.High variance#1.news	1.0230 (0.6308)	-0.0522 (1.0606)	0.9590 (0.6153)
1.Low variance	-3.0069*** (0.4836)	-2.1682*** (0.2879)	-2.7626*** (0.3873)
1.Low variance#1.news	1.0893* (0.5707)	0.1672 (0.7318)	0.8877* (0.5199)
1.Placebo	-1.9013*** (0.5253)	-0.4902* (0.2620)	-1.4509*** (0.4505)
1.Placebo#1.news	1.8967*** (0.5966)	0.1566 (0.8583)	1.4847*** (0.5390)
Constant	3.8154*** (0.4710)	2.8808*** (0.2510)	3.8064*** (0.4107)
N	1606.000	1606.000	1606.000
r ²	0.573	0.575	0.577
Mean only + News $\neq$ 0	0.000	0.016	0.000
Large variance + News $\neq$ 0	0.000	0.111	0.000
Low variance + News $\neq$ 0	0.000	0.003	0.000
Placebo + News $\neq$ 0	0.987	0.683	0.909

Appendix: Household's Problem

$$V_{\Lambda}(\pi^e, a) = \max_{\Lambda} \{ \Lambda(V(\pi, a) - \kappa) + (1 - \Lambda)V(\pi^e, a) - \theta D(\Lambda || \bar{\Lambda}) \}$$

$$V(\pi^e, a) = \frac{(c^*)^{1-\sigma}}{1-\sigma} + \beta V_{\Lambda}(\pi^e, a'^*)$$

and c^*, a'^* correspond to the c, a' that solve

$$\max_{c, \ell, a', c', \ell', a''} \frac{c^{1-\sigma}}{1-\sigma} + \beta \mathbb{E} \left[\frac{(c')^{1-\sigma}}{1-\sigma} + \beta^2 V_{\Lambda}(\pi^e, a'') \right] \text{ s.t.}$$

$$c + a' \leq (1+i)a + w\ell$$

$$c' + a'' \leq \frac{1+i}{1+\pi^e} a' + \frac{w}{1+\pi^e} \ell'$$

$$a', a'' \geq 0$$

► Back