

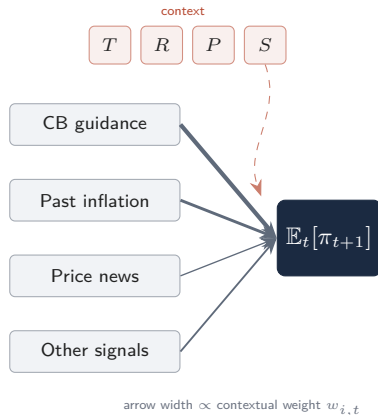
Contextual Expectations and Inflation Dynamics

Theory, calibration to Turkey, and a randomized information experiment

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Motivation: why do agents underweight signals they can see?

- Expectations drive pricing, wages, and policy transmission
- Workhorse paradigms (Muth 1961; Lucas 1972; Cagan 1956):
 - ▶ **RE**: model-consistent use of all information
 - ▶ **AE**: mechanical adjustment to past inflation
- Evidence points elsewhere:
 - ▶ households ignore policy news unless personally relevant (Coibion et al. 2022)
 - ▶ persistent heterogeneity in reading the *same* signals (Mankiw et al. 2003; D'Acunto et al. 2021)

The puzzle

An agent may see the central bank's signal (no sticky information) and be *able to process* it (no inattention) — yet still **underweight** it, because its context makes it less compelling than backward-looking alternatives.

Question. How does the *context* of a signal — trust, relevance, prominence, similarity to experience — determine the weight it receives, and what does this imply for inflation persistence, re-anchoring, and the cost of disinflation?

This paper

1. **Framework.** *Contextual Expectations* (CE): signals mixed with softmax weights over trust, relevance, prominence, similarity, plus memory. Nests RE and AE.
2. **Macro implications.** State-dependent persistence; a *credibility trap*; Taylor principle intact; **sacrifice ratio rises as credibility falls.**
3. **Quantification.** Calibration to Turkey (2013–2023); target, credibility and political-interference simulations.
4. **Causal micro evidence.** Randomized information-update experiment ($N = 1,520$) identifies the weights, $\hat{w}_{CB} = 0.47$ and $\hat{w}_B = 0.33$.

Positioning. Sticky information (Mankiw–Reis): *how often* agents update · rational inattention (Sims): *how much* they process · behavioral NK (Gabaix; Angeletos–Huo): *fixed* discounting.

CE: *how much weight* a seen-and-processed signal gets, given its context — **endogenous, time-varying.**

Headline. At the experimentally estimated degree of anchoring, the sacrifice ratio is $\approx$ **58%** higher than under full credibility.

The Contextual Expectations (CE) framework

Expectation = convex combination of n signals

$$\mathbb{E}_t[\pi_{t+1}] = \sum_{i=1}^n w_{i,t} I_{i,t}, \quad w_{i,t} = \frac{C_{i,t}}{\sum_j C_{j,t}}$$

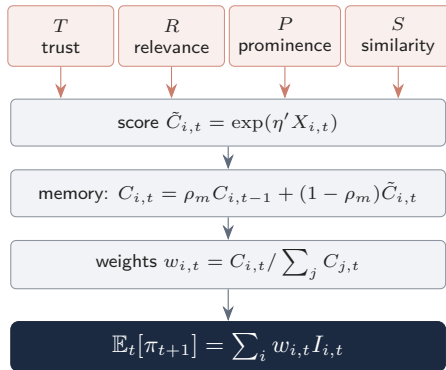
Instantaneous contextual score

$$\tilde{C}_{i,t} = \exp(\eta_T T_{i,t} + \eta_R R_{i,t} + \eta_P P_{i,t} + \eta_S S_{i,t})$$

Memory (relevance stock)

$$C_{i,t} = \rho_m C_{i,t-1} + (1 - \rho_m) \tilde{C}_{i,t}, \quad \rho_m \in [0, 1]$$

- $\rho_m = 0$: multinomial logit;
 $\log(w_{i,t}/w_{\text{ref},t}) = \eta'(X_{i,t} - X_{\text{ref},t})$ is *linear* in context $\Rightarrow$ identifiable from randomized signals
- Agent-specific $\eta_j \Rightarrow$ heterogeneous expectation formation



signals $I_{i,t}$: CB guidance, past inflation, price news, ...

Two-signal reduction, microfoundation, and nesting

Backward signal π_{t-1} vs. central bank target π^* (binary logit):

$$\mathbb{E}_t[\pi_{t+1}] = w_t \pi_{t-1} + (1 - w_t) \pi^*$$
$$w_t = \frac{1}{1 + \exp\{-(V_{B,t} - V_{CB,t})\}}$$

Credibility stock — erodes with squared misses:

$$T_{CB,t} = \rho_T T_{CB,t-1} - \gamma (\pi_{t-1} - \pi^*)^2$$

$\Rightarrow$ to first order, with $\Delta_t \equiv \pi_t - \pi^*$:

$$V_{B,t} - V_{CB,t} \approx a + \theta \Delta_{t-1}$$

a : baseline credibility ($a < 0$: guidance dominates at target);

$\theta > 0$: speed of reweighting toward the past as the gap widens.

CE nests the benchmarks

RE limit. $w_{CB} \rightarrow 1$ and the CB signal is the model-consistent forecast $\Rightarrow \mathbb{E}_t^{CE} = \mathbb{E}_t^{RE}$ as a fixed point — reached through *maximal credibility*, not assumed.

AE limit. Constant $w_B = \lambda$, anchor $\mathbb{E}_{t-1}[\pi_t] \Rightarrow \mathbb{E}_t^{CE} = \lambda \pi_{t-1} + (1 - \lambda) \mathbb{E}_{t-1}[\pi_t]$.

In between. Weights move with the macro state and credibility $\Rightarrow$ AE-like inertia arises *endogenously*.

Implications I: persistence and the grip of policy

Prop. 1 — persistence is state-dependent

NKPC $\pi_t = \kappa y_t + \beta \mathbb{E}_t[\pi_{t+1}] + \varepsilon_t$ with two-signal CE:

$$\pi_t = \underbrace{\beta w_t}_{\rho_t^{eff}} \pi_{t-1} + \beta(1 - w_t)\pi^* + \kappa y_t + \varepsilon_t$$

- $\rho_t^{eff} \uparrow$ when trust falls or similarity to lived prices rises
- $w_t \rightarrow 0$ (full credibility): persistence vanishes absent serially correlated shocks

Prop. 2 — policy works through w_{CB}

$$\frac{\partial \mathbb{E}_t[\pi_{t+1}]}{\partial I_{CB,t}} = w_{CB,t} = \frac{e^{V_{CB,t}}}{\sum_j e^{V_{j,t}}}$$

- The grip of communication on expectations is proportional to its weight — a softmax in (T, R, P, S) relative to competing sources

Remark (total effect). $\frac{d\mathbb{E}_t[\pi_{t+1}]}{dI_{CB,t}} = w_{CB,t} + \sum_i I_{i,t} \frac{\partial w_{i,t}}{\partial I_{CB,t}}$ A hawkish surprise that *builds* trust amplifies the direct effect; a non-credible signal can attenuate or even *reverse* it.

Implications II: a high-inflation credibility trap

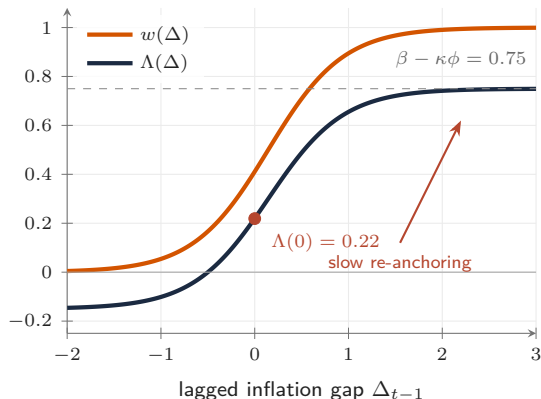
Gap NKPC, lagged rule $y_t = -\phi\Delta_{t-1}$, CE weight on past inflation $w(\Delta) = \sigma(a + \theta\Delta)$:

$$\Delta_t = \Lambda(\Delta_{t-1}) \Delta_{t-1} + \varepsilon_t, \quad \Lambda(\Delta) \equiv \beta w(\Delta) - \kappa\phi$$

Prop. 4 ($\beta = 0.9$, $\kappa = 0.3$, $\phi = 0.5$, $a = -0.36$)

- **At target:** $\Lambda(0) = 0.9 \times 0.41 - 0.15 = 0.22$ (0.30 if $a = 0$) — fast convergence
- **Far above target:** $w \rightarrow 1$, $\Lambda \rightarrow \beta - \kappa\phi = 0.75$ — near-unit-root behavior
- **Below target:** Λ can turn negative — oscillatory but stable

Unique steady state at π^* — yet far above target inflation *behaves* as if nearly non-stationary.



Calibrated $w(\Delta)$, $\Lambda(\Delta)$: a from the experiment, $\theta = 2.5$ by SMM.

Implications III: determinacy vs. the cost of disinflation

Three-equation NK model with CE-distorted expectations:

$$\mathbb{E}_t^{CE}[\pi_{t+1}] = \bar{w}_{CB} \mathbb{E}_t[\pi_{t+1}] + (1 - \bar{w}_{CB}) \pi_{t-1}$$

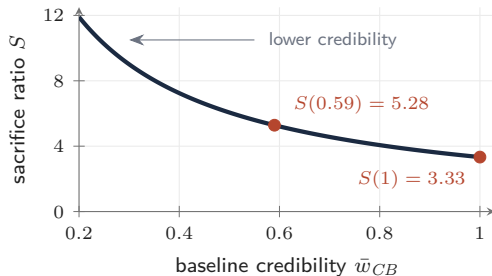
Prop. 5 (determinacy). Unique equilibrium iff

$$\phi_\pi + \frac{1-\beta}{\kappa} \phi_y > 1, \quad p(1) = \kappa(\phi_\pi - 1) + (1 - \beta)\phi_y$$

— *independent of $\bar{w}_{CB}$* : CE changes propagation, not the boundary.

Prop. 7 (sacrifice ratio). Decreasing in $\bar{w}_{CB}$:

$$S(\bar{w}_{CB}) = \frac{1}{\kappa} \frac{1}{1 - \beta(1 - \bar{w}_{CB})}$$

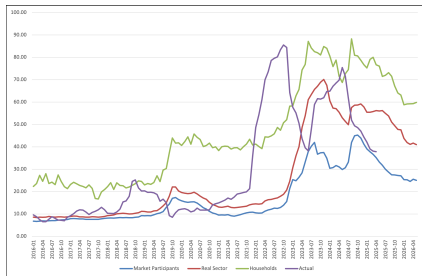


Calibration ($\beta = 0.9, \kappa = 0.3$)	$\bar{w}_{CB}$	S
Full credibility	1.00	3.33
Experimentally anchored	0.59	5.28 (+58%)
Purely backward-looking	0.00	33.3

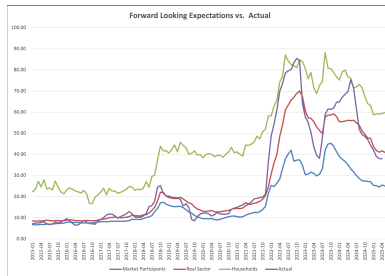
CE does not change *whether* policy can pin down inflation — it changes *how costly* it is to bring it down.

Stylized facts: heterogeneous expectations in Turkey

(a) Concurrent expectations vs. actual inflation



(b) 12-month-ahead expectations vs. realized inflation



Market participants (blue), real sector (red), households (green), realized CPI inflation (purple); y-o-y, pp.

- **Large, time-varying dispersion:** households higher and slower; markets more volatile; real sector in between. In high-inflation episodes all groups re-anchor upward — to *different* plateaus.
- **Forward-matched (b):** real sector closest to a unit slope with little bias; households a persistent level offset; markets overshoot.

Same macro signals, *group-specific* filters: exactly the time-varying weights CE is built to capture.

Calibration to Turkey (quarterly, 2013–2023)

	Parameter	Value
η_T	weight on trust	0.30
η_R	weight on relevance	0.25
η_P	weight on prominence	0.20
η_S	weight on similarity	0.25
ρ_m	memory	0.70
θ	state-dependence sensitivity	2.50
a	baseline credibility intercept	-0.36
κ, β	NKPC slope, discount factor	0.30, 0.90
ϕ	policy response	0.50
ρ_y, σ	output-gap persistence, inv. EIS	0.80, 1.00
$\sigma_\varepsilon, \sigma_\nu$	shock s.d.	0.01, 0.02

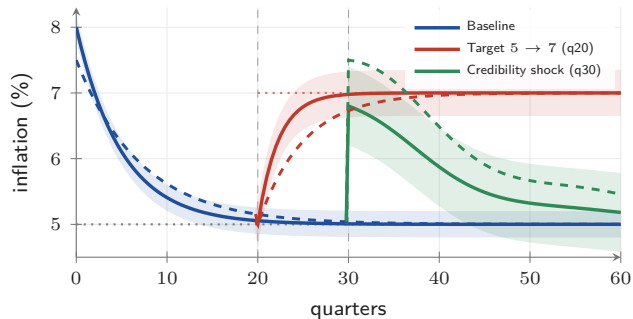
η 's: normalized linear coefficients — local approximations to the nonlinear relevance function.

Where the numbers come from

- **Trust:** $\mathbb{E}_{i,t}[\pi_{t+12}]$ on CB-trust index: -0.73 (0.09), $N = 4,280$
- **Relevance** $+0.58$ (0.11); **similarity** (experienced inflation) $+0.61$ (0.08)
- **Prominence:** media-coverage index $+0.38$ (0.06), 44 quarters
- **Memory:** AR(1) of median expectations, $\hat{\rho} = 0.72$ (0.08)
- θ : SMM (variance, corr. with lagged π , skewness of revisions 2018–22); 95% CI [1.8, 3.2]
- a : from the experiment —

$$w_B(0) = \frac{0.33}{0.33+0.47} = 0.41 \Rightarrow a = \ln \frac{0.41}{0.59} = -0.36$$

Simulations: a target change vs. a credibility loss

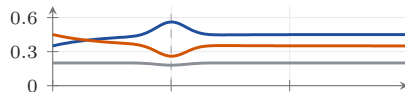


Solid: inflation; dashed: expectations; shaded: 95% band around inflation.

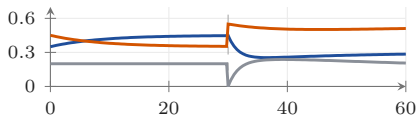
Baseline. Inflation and expectations converge to the 5% target within ≈ 15 quarters.

Target change. Expectations lag inflation; w_{CB} rises temporarily ($0.44 \rightarrow 0.56$); new target reached in ≈ 10 quarters.

Weights: target change (q20)



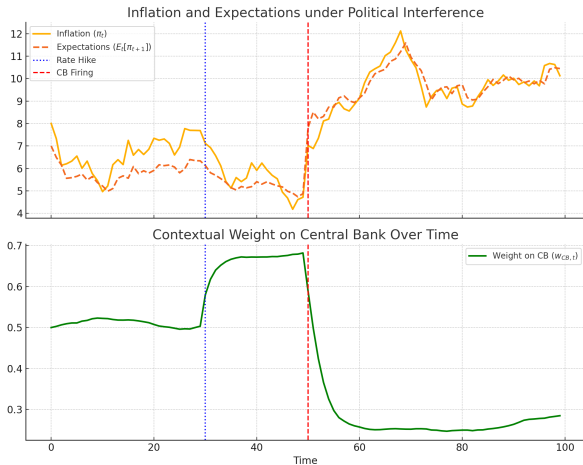
Weights: credibility shock (q30)



$w_{CB,t}$ $w_{\pi,t}$ $w_{other,t}$

Credibility shock. Expectations overshoot; w_{CB} $0.45 \rightarrow 0.25$, w_{π} $0.35 \rightarrow 0.55$; band $\pm 0.25 \rightarrow \pm 0.6$ pp; re-anchoring ≈ 20 quarters.

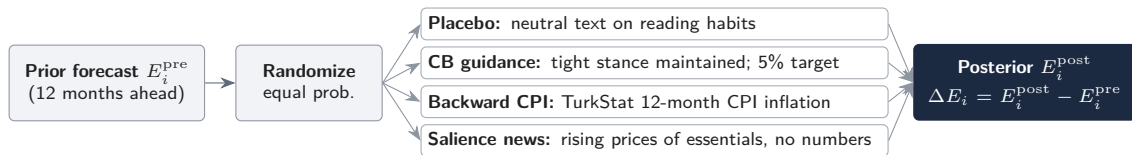
Counterfactual: political interference



- **Start:** moderate credibility, $w_{CB} \approx 0.5$
- **Rate hike ($t = 30$):** w_{CB} rises to ≈ 0.7 ; inflation and expectations decline — *gradual, partial disinflation*
- **Governor dismissed ($t = 50$):** $w_{CB} < 0.3$ within a few periods and stays depressed (memory); inflation jumps, expectations follow closely
- **Asymmetry:** credibility is earned slowly, lost quickly

Protecting central bank independence is at least as important as technically sound policy actions.

Micro evidence: a randomized information-update experiment



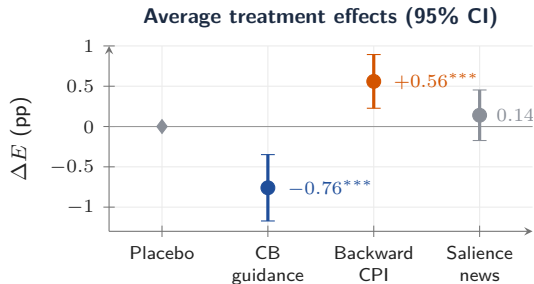
Contextual indices (standardized)

- T : trust, credibility, independence, clarity of the CB
- R : budget/job sensitivity, variable-rate debt, indexation
- P : PC1 of economic-news exposure
- S : similarity of own budget shares to CPI weights + price encounters

Sample and inference

- Online panel; quotas on age, gender, region; $N = 1,520$
- Mean prior $E^{\text{pre}} = 18.4\%$ (s.d. 6.2)
- Pre-registered; 80% power for 0.4 pp; ITT, robust s.e.; attention checks

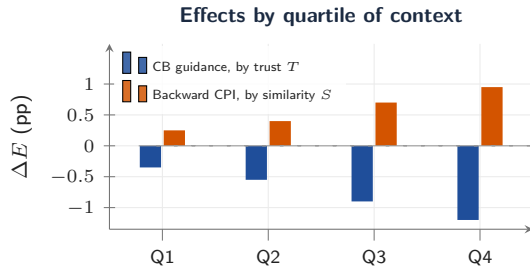
Results: guidance lowers, backward CPI raises — conditional on context



Interactions (Table 3, col. 3)

$CB \times T$ -0.18^{***} (0.05); $CB \times P$ -0.09^{**} (0.04);
 $CPI \times S$ $+0.14^{**}$ (0.06)

$CPI \times R$ 0.06; $News \times P$ 0.03. Saliency null: price narratives without numbers do not move expectations.



CE weights (minimum distance, ATEs $\leftrightarrow$ model):

$\hat{w}_{CB} = 0.47$, $\hat{w}_B = 0.33$, $\hat{w}_{News} = 0.08$,
residual 0.12

Robust: attentive-only (-0.82^{***} , $+0.61^{***}$), log updates.

Closing the loop, and conclusions



1. **Persistence is not structural.** It tracks the weight on backward- vs. forward-looking information ($\rho_t^{eff} = \beta w_t$) and becomes a credibility trap far above target.
2. **Communication works through weights.** The grip of policy is $\propto w_{CB}$, shaped by trust, relevance, prominence, similarity — confirmed causally.
3. **Incomplete anchoring is costly.** The Taylor principle is unchanged, but the sacrifice ratio is $\approx 58\%$ higher at estimated credibility.
4. **Credibility is lost fast and rebuilt slowly.** Institutional independence is first-order monetary policy.

Next: structural (nonlinear) estimation of η ; learning and rational inattention inside CE; optimal policy under CE.

Thank you! ceyhunelgin@gmail.com

Backup: determinacy algebra (Prop. 5)

Perfect foresight, no shocks; CE NKPC $\pi_t = \kappa y_t + \beta \bar{w}_{CB} \pi_{t+1} + \beta(1 - \bar{w}_{CB}) \pi_{t-1}$, IS curve and Taylor rule. With $x_t = (\pi_t, y_t, \pi_{t-1})'$, $x_{t+1} = Mx_t$:

$$M = \begin{pmatrix} \frac{1}{\beta \bar{w}_{CB}} & -\frac{\kappa}{\beta \bar{w}_{CB}} & \frac{\bar{w}_{CB} - 1}{\bar{w}_{CB}} \\ \frac{\phi_\pi}{\sigma} - \frac{1}{\beta \sigma \bar{w}_{CB}} & 1 + \frac{\phi_y}{\sigma} + \frac{\kappa}{\beta \sigma \bar{w}_{CB}} & \frac{1 - \bar{w}_{CB}}{\sigma \bar{w}_{CB}} \\ 1 & 0 & 0 \end{pmatrix}$$

- One predetermined state $(\pi_{t-1}) \Rightarrow$ determinacy requires exactly one root inside the unit circle (Blanchard–Kahn)
- Boundary at $\lambda = 1$: $p(1) \propto \kappa(\phi_\pi - 1) + (1 - \beta)\phi_y$ — **independent of $\bar{w}_{CB}$**
- $p(-1) \neq 0$ for admissible calibrations (no flip bifurcation); eigenvalue loci over $\bar{w}_{CB} \in [0.3, 0.7]$ show no Hopf crossings
- Remaining roots depend on $\bar{w}_{CB}$: as $\bar{w}_{CB} \downarrow$, the stable root $\rightarrow 1 \Rightarrow$ more persistence, steeper tradeoff (Remark 6)

Backup: calibration regressions

$$\mathbb{E}_{i,t}[\pi_{t+12}] = \underset{(0.42)}{12.85} - \underset{(0.09)}{0.73} \cdot \text{Trust}_{i,t} + \underset{(0.04)}{0.52} \cdot \pi_{t-1} + X'_{i,t}\gamma, \quad R^2 = 0.31, N = 4,280$$

$$\mathbb{E}_{i,t}[\pi_{t+12}] = \underset{(0.38)}{14.21} + \underset{(0.11)}{0.58} \cdot \text{Relevance}_{i,t} + \underset{(0.04)}{0.48} \cdot \pi_{t-1} + X'_{i,t}\gamma, \quad R^2 = 0.28, N = 4,280$$

$$\bar{\mathbb{E}}_t[\pi_{t+12}] = \underset{(1.12)}{3.45} + \underset{(0.06)}{0.38} \cdot \text{Prominence}_t + \underset{(0.05)}{0.55} \cdot \pi_{t-1}, \quad R^2 = 0.72, N = 44$$

$$\mathbb{E}_{i,t}[\pi_{t+12}] = \underset{(0.51)}{8.92} + \underset{(0.08)}{0.61} \cdot \text{Experienced inflation}_{i,t} + X'_{i,t}\gamma, \quad R^2 = 0.34, N = 3,850$$

- Trust: WVS / Eurobarometer waves and the CBRT Survey of Expectations; prominence: keyword-based media index (Hürriyet, Sabah, Milliyet, online portals), following Carroll (2003); experienced inflation as in Malmendier & Nagel (2016)
- Absolute coefficients normalized to sum to one $\Rightarrow (\eta_T, \eta_R, \eta_P, \eta_S) = (0.30, 0.25, 0.20, 0.25)$
- Memory: $\bar{\mathbb{E}}_t[\pi_{t+12}] = \mu + \rho \bar{\mathbb{E}}_{t-1}[\pi_{t+11}] + u_t$, $\hat{\rho} = 0.72$ (0.08) $\Rightarrow \rho_m = 0.70$
- θ : SMM minimized at 2.5, bootstrap 95% CI [1.8, 3.2]

Backup: experimental treatments (exact wording)

Placebo “Recent studies on digital literacy suggest that reading habits are changing. People are increasingly consuming news through social media platforms rather than traditional print newspapers, affecting how information spreads in society.”

CB guidance “According to the most recent Inflation Report, the Central Bank of the Republic of Turkey emphasizes that tight monetary stance will be maintained until the inflation outlook improves significantly. The Bank reaffirms its medium-term inflation target of 5%.”

Backward CPI “The latest data released by TurkStat shows that consumer prices (CPI) increased by [Actual %] percent over the last 12 months. Food and energy prices were the main contributors to the recent increase in the index.”

Salience news “Consumers are reporting higher prices at the supermarket and gas pumps this month. Many families state that the rising cost of daily essentials like vegetables, electricity, and transportation is putting pressure on household budgets.”

Estimation: $\Delta E_i = \beta_A CB_i + \beta_B CPI_i + \beta_C News_i + X_i' \gamma + \varepsilon_i$; heterogeneity adds $D_{k,i} \times \{T_i, R_i, P_i, S_i\}$; weights by minimum distance $\min_w \sum_k (\hat{\beta}_k - \bar{m}_k w_k)^2$ s.t. $w \geq 0, \sum w \leq 1$.

Backup: sample and robustness



Descriptive statistics

	Mean	S.D.	<i>N</i>
Prior E^{pre} (%)	18.42	6.15	1,520
Update ΔE (pp)	−0.12	2.30	1,520
Age	34.5	11.2	1,520
Female	0.48	0.50	1,520
University degree	0.38	0.49	1,520

Indices T , R , P , S standardized; E^{pre} winsorized at 2/98%.

Robustness of treatment effects

	Full	Attentive	Log-update
CB guidance	−0.76*** (0.21)	−0.82*** (0.23)	−0.05*** (0.01)
Backward CPI	0.56*** (0.17)	0.61*** (0.19)	0.04** (0.02)
Salience news	0.14 (0.16)	0.11 (0.18)	0.01 (0.01)
<i>N</i>	1,520	1,345	1,520
R^2	0.079	0.085	0.062