

How Firms Form Beliefs and the Implications for Inflation

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Inflation: Drivers and Dynamics 2026

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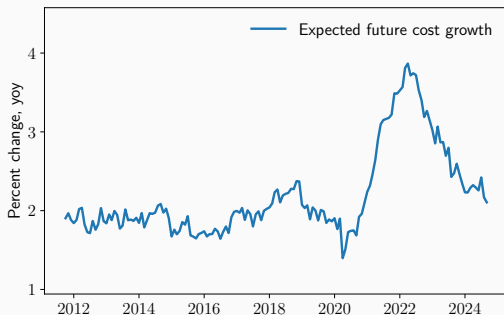
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How do firms form inflation-relevant beliefs?

- Primitive beliefs in NK price-setting: **firms' own expected future marginal costs.**

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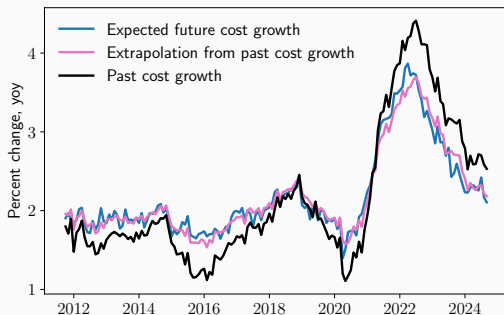
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- **Question:** How do aggregate shocks drive these **expectations**?



Time series of firms' cost forecasts.

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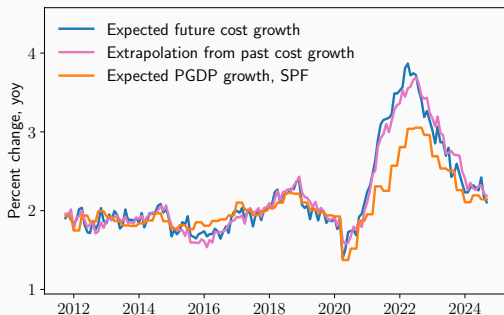
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Linear fit of cost
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- **Literature:** Focused on **aggregate inflation expectations.**



SPF PGDP forecast:
similar time series.

Results Preview

New evidence on how firms forecast their own future costs.

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Aggregate implications of these beliefs.

- Under fully *Adaptive Learning*, the model delivers a Friedman-Phelps Phillips curve.

$$\pi_t = \omega_0 mc_t^{\text{real}} + \omega_1 \sum_{\ell=1}^{\infty} \omega_2^{\ell} \pi_{t-\ell} \quad (\text{Special case})$$

But microfounded from firm-level beliefs and pricing problem.

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- Supply shocks are more inflationary, demand shocks are less inflationary.
- Forward guidance weaker at long horizons, but stronger in near term.

1. Deviations from full-information rational expectations (FIRE)

- ▶ Maćkowiak and Wiederholt (2009), Coibion and Gorodnichenko (2015), Bordalo et al. (2020), Broer and Kohlhas (2022), Kohlhas and Walther (2021), Angeletos et al. (2021)

2. Firms' beliefs (focused on CPI beliefs)

- ▶ Kumar et al. (2015), Coibion et al. (2018), Coibion et al. (2020), Coibion et al. (2021), Weber et al. (2022), Candia et al. (2023), Kumar et al. (2023), Afrouzi (2023), Baumann et al. (2024), Savignac et al. (2024), Bloom et al. (2025), Andrade et al. (2026)

3. Households learning “locally”: Taubinsky et al. (2024), D'Acunto et al. (2021)

4. Firms learning from: own sales (Dovern et al. (2023)), own prices (Andrade et al. (2022), Born et al. (2022), Gagliardone and Tielens (2026)), own costs (Albagli et al. (2022) for beliefs about CPI)

- ▶ *We study firms using local information to forecast own costs.*

5. Macroeconomic implications of non-FIRE beliefs

- ▶ Lucas Jr (1972), Evans and Honkapohja (2001), Mankiw and Reis (2002), Lorenzoni (2009), Bordalo et al. (2018), Gabaix (2020), Angeletos and Huo (2021), La'O and Tahbaz-Salehi (2022), Kohler et al. (2025)

6. Papers using the Business Inflation Expectations (BIE) dataset

- ▶ Meyer et al. (2022), Meyer and Sheng (2025)

New facts about firms' own-cost expectations

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- Assign probabilities to same five scenarios for **cost growth over the next 12 months**,

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- Panel allows us to construct firm-level year-ahead **forecast error**

$$\begin{aligned} FE_{i,t,t+12} &\equiv mc_{i,t+12} - \mathbb{E}_{i,t} [mc_{i,t+12}] \\ &= \Delta_{12}mc_{i,t+12} - \mathbb{E}_{i,t} [\Delta_{12}mc_{i,t+12}] \end{aligned}$$

New facts about how firms forecast their costs

Fact 1. Firms' CPI and own-cost beliefs are disconnected. Passthrough ≈ 0.15 .

Fact 2. Firms extrapolate from their *own* costs. Passthrough ≈ 0.3 .

Firms over-react to their own costs, by ≈ 0.2 .

Fact 3. This extrapolation is stable across time and observable characteristics.

Fact 4. Firms learn persistently from past costs.

Fact 5. Beliefs react to aggregate shocks primarily once own costs move.

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Need to study own-cost beliefs to understand cost channel of inflation.

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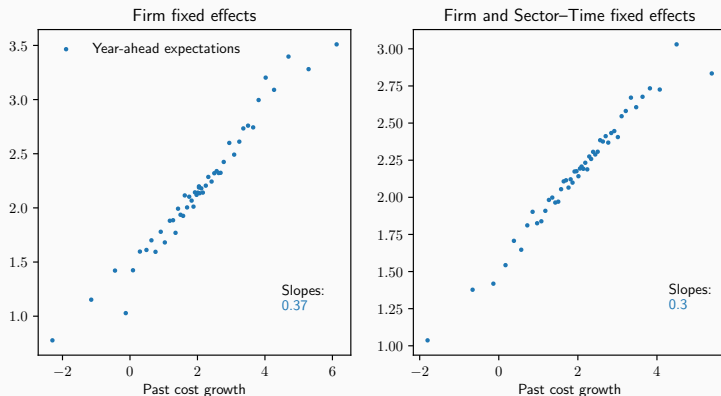
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Fact 2: Firms react to their own costs

Expectation $\mathbb{E}_{i,t} [\Delta_{12}mc_{i,t+12}]$ vs. past cost growth $\Delta_{12}mc_{i,t}$



Firms' cost forecasts depend on idiosyncratic costs.

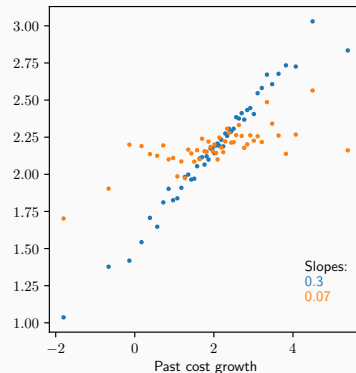
Note: 50 bins, each contain an equal number of observations. Data is residualized on the fixed effects then binned.

Fact 2: Firms (over) react to their own costs

Expectation $\mathbb{E}_{i,t} [\Delta_{12}mc_{i,t+12}]$ and Realization $\Delta_{12}mc_{i,t+12}$ vs. past cost growth $\Delta_{12}mc_{i,t}$



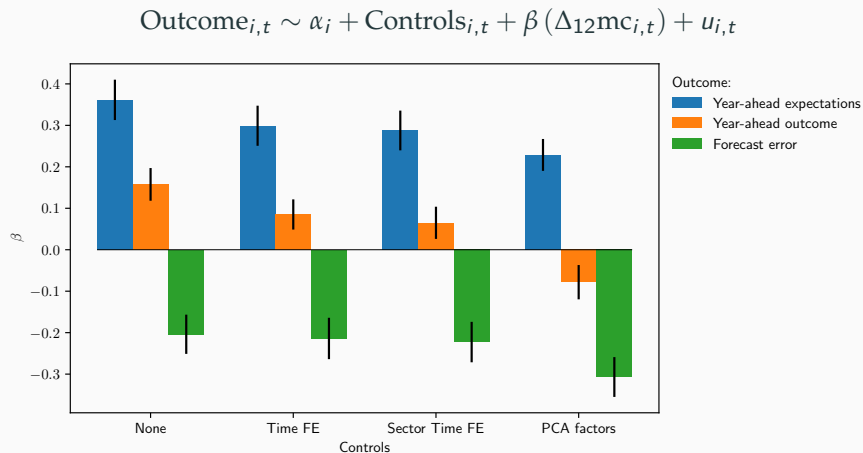
Firm and Sector-Time fixed effects



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Note: Black lines are 95% confidence intervals, standard errors clustered at firm level.

- Firms' cost forecasts depend on idiosyncratic cost movements.
- Forecast errors predictable from firms' cost reports $\implies$ Failure of RE.

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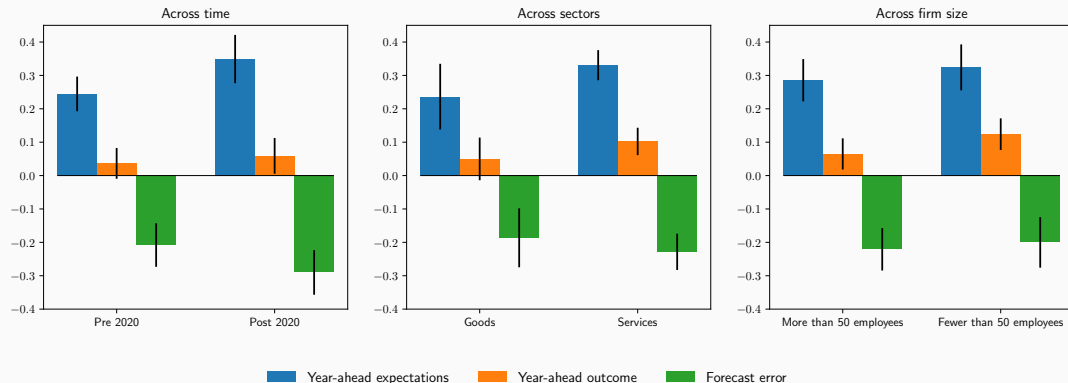
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Fact 3: Extrapolation from own costs is stable

- Stable across time, sectors, and firm size.



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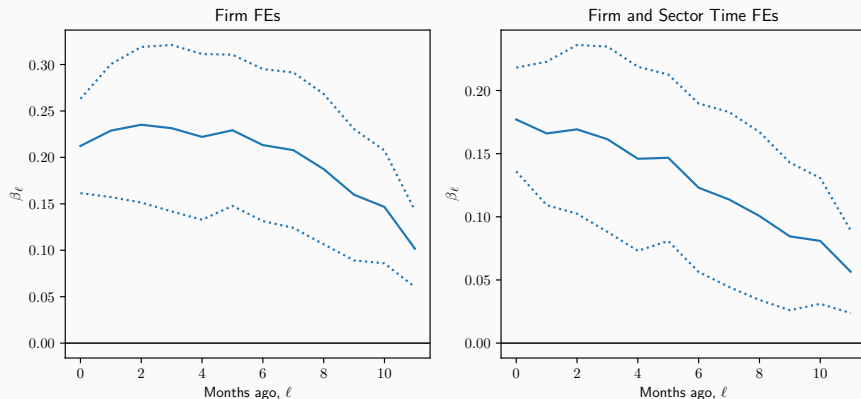
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Fact 4: Firms learn from their costs persistently over time

$$\mathbb{E}_{i,t} [\Delta_{12}mc_{i,t+12}] \sim \alpha_i + \text{Controls}_{i,t} + \sum_{\ell=0}^L \beta_{\ell} \Delta mc_{i,t-\ell} + u_{i,t}$$



Note: Dotted lines are 95% confidence intervals, standard errors clustered at firm level.

- And firms significantly over-react to cost growth strictly in the past.

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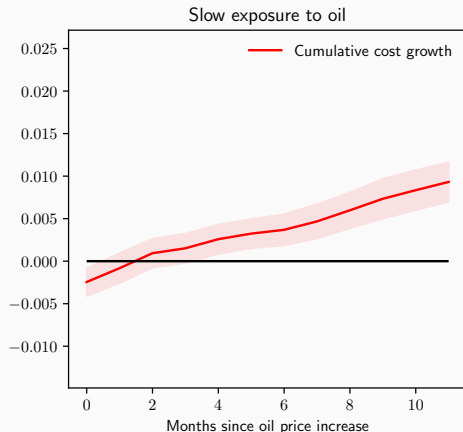
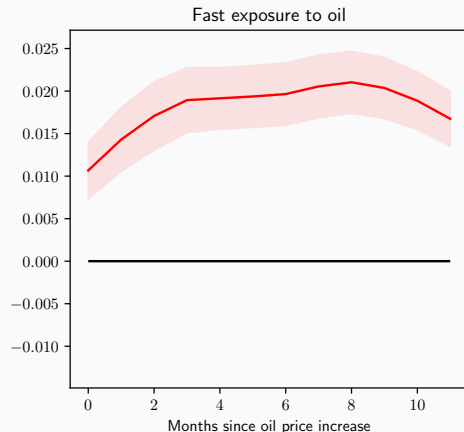
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Beliefs react to oil-price shocks primarily once costs move

- Split sample into firms whose costs are affected more quickly or slowly by oil prices.

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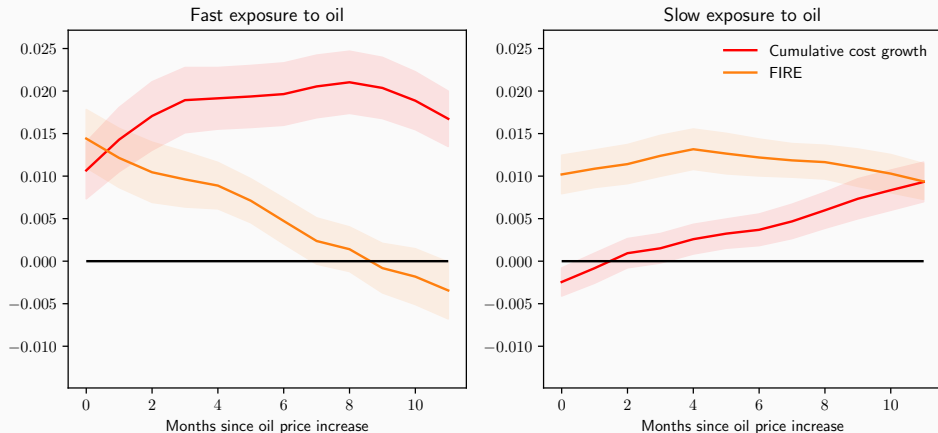
- Split sample into firms whose costs are affected more quickly or slowly by oil prices.
- Local projections onto $\Delta_3 p_t^{\text{oil}}$: $\Delta_{12} mc_{i,t+h}$



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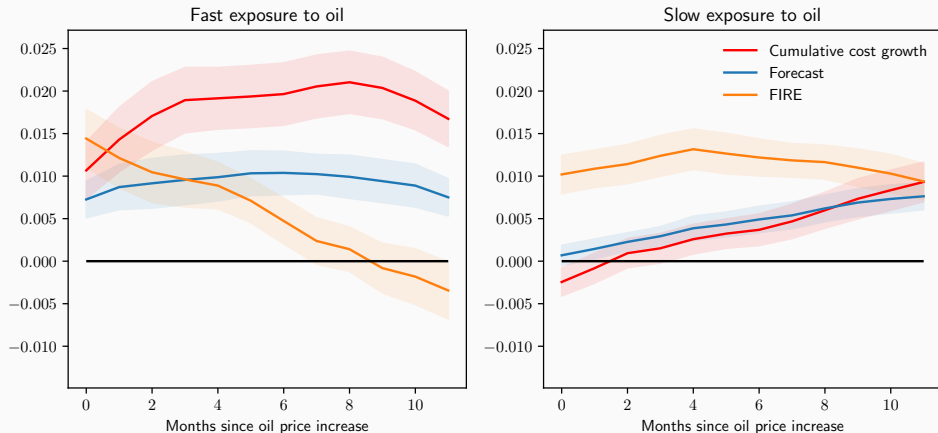
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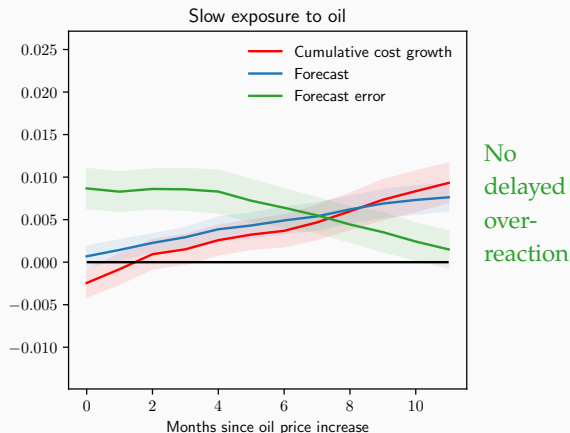
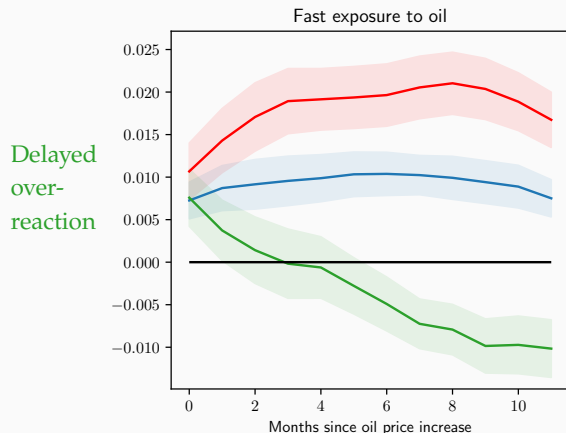
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A calibrated model of firms' beliefs

A model of “Adaptive Learning”

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AHS (2021) but
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- Calibrating the beliefs model requires estimates for $\tilde{\rho}$, $\tilde{\mathcal{K}}$, and α^{FIRE} .

Calibrating our model of firm beliefs

- Since data is in annual changes, cast model in annual time.
- To build intuition, set $\tilde{\mathcal{K}}^{\text{ann}} = 1$ and start by estimating just α^{FIRE} and $\tilde{\rho}^{\text{ann}}$.

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- Need instrument that (1) predicts future costs, (2) known at time t .
- Same intuition as Fact 5: we use estimated reactions to aggregate shocks.
 - ▶ We use monetary policy shocks, average costs, and CPI as instruments.

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- To build intuition, set $\tilde{\mathcal{K}}^{\text{ann}} = 1$ and start by estimating just α^{FIRE} and $\tilde{\rho}^{\text{ann}}$.

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where $\varepsilon_{i,t+1,t+12}^{\text{FIRE}} \equiv \alpha^{\text{FIRE}} (\mathbb{E}_t [\Delta_{12}\text{mc}_{i,t+12}] - \Delta_{12}\text{mc}_{i,t+12})$.

- Need instrument that (1) predicts future costs, (2) known at time t .
- Same intuition as Fact 5: we use estimated reactions to aggregate shocks.
 - ▶ We use monetary policy shocks, average costs, and CPI as instruments.
- To also recover $\tilde{\mathcal{K}}^{\text{ann}}$ return to general model and include lagged costs.

Annual calibration

		$\mathbb{E}_{i,t} [\Delta_{12}mc_{i,t+12}]$		
Regression Estimates	$\Delta_{12}mc_{i,t}$	0.236*** (0.022)	0.243*** (0.021)	0.236*** (0.020)
	$\Delta_{12}mc_{i,t-12}$	0.040*** (0.015)	0.034** (0.015)	0.039*** (0.015)
	$\Delta_{12}mc_{i,t+12}$	0.251*** (0.043)	0.200*** (0.036)	0.246*** (0.059)
Implied Parameters	α^{FIRE}	0.251 (0.043)	0.200 (0.036)	0.246 (0.059)
	$\hat{\kappa}^{ann}$	0.650 (0.105)	0.687 (0.112)	0.654 (0.098)
	$\hat{\rho}^{ann}$	0.484 (0.059)	0.442 (0.058)	0.479 (0.065)
Instrument		Av. Costs $\times$ Firm id	CPI $\times$ Firm id	NS $\times$ Firm id
Min obs per firm		4 years	4 years	4 years
Observations		8762	8762	8762
Kleibergen Paap F stat		4356	4258	3143

Note: *p<0.10, **p<0.05, ***p<0.01. Estimate by 2SLS. All regressions include Firm and Time fixed effects. Driscoll Kraay standard errors with bandwidth 12.

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Firms' beliefs are mostly Adaptive

- This gives us the quarterly calibration

$$\alpha^{\text{FIRE}} = 0.25, \quad \tilde{\rho} = 0.82, \quad \tilde{\mathcal{K}} = 0.22$$

- So our calibrated model of firm beliefs is

$$\mathbb{E}_{i,t} [\Delta mc_{i,t+\tau}] = 0.25 \times \mathbb{E}_t [\Delta mc_{i,t+\tau}] + 0.16 \times 0.82^\tau \times \sum_{\ell=0}^{\infty} 0.64^\ell \Delta mc_{i,t-\ell}$$

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α^{FIRE}

$(1 - \alpha^{\text{FIRE}})\tilde{\mathcal{K}}$

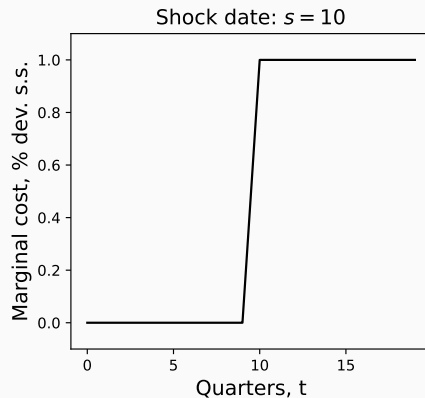
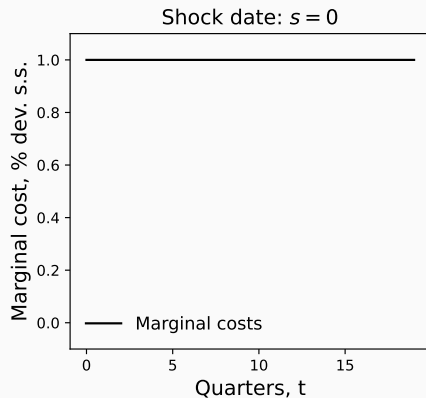
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The Phillips Curve in Calvo Pricing Model

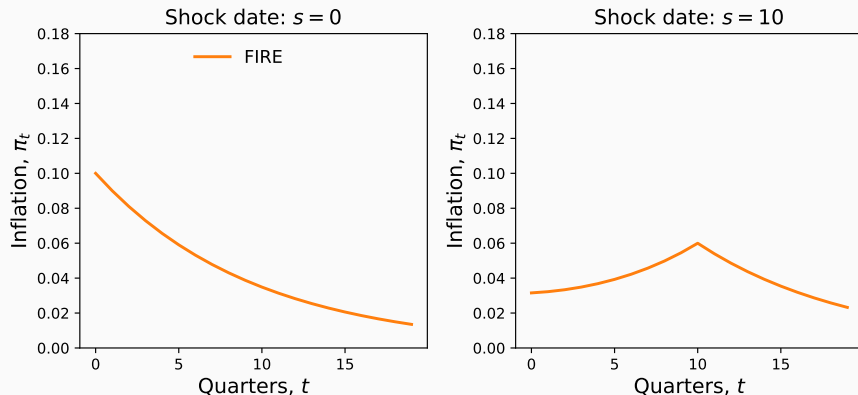
Inflation under Adaptive Learning: weak anticipation, strong passthrough

Inflation response to 1pp permanent change in nominal marginal costs at date s .



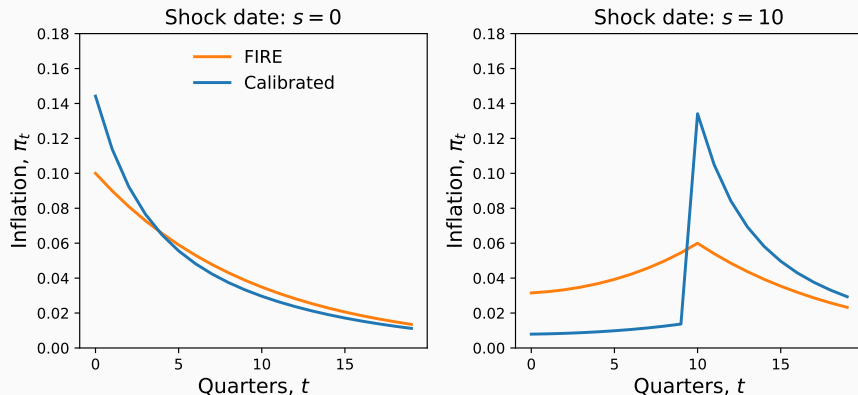
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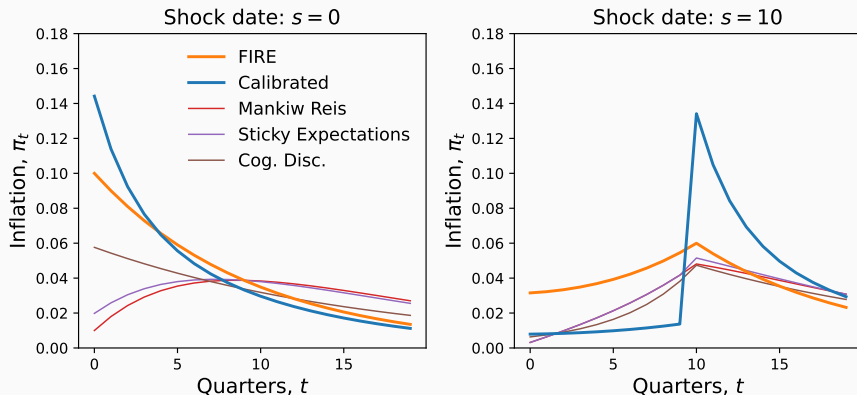
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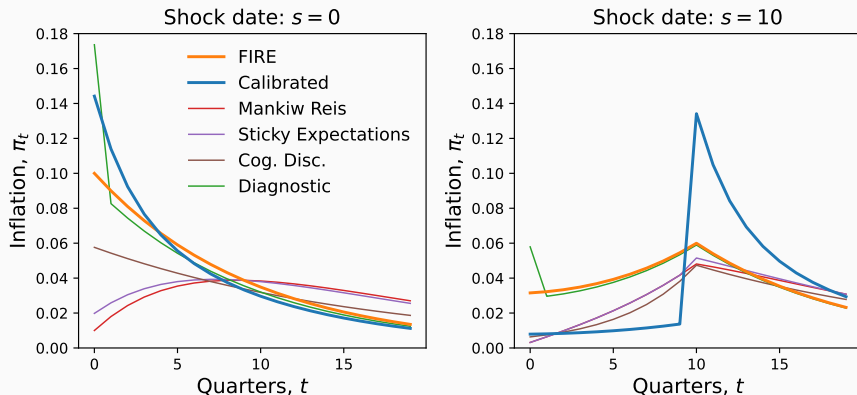
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Inflation under Adaptive Learning: weak anticipation, strong passthrough

Inflation response to 1pp permanent change in nominal marginal costs at date s .



- Mankiw Reis, sticky expectations, cognitive discounting $\implies$ dampened response
- Diagnostic expectations $\implies$ higher expectations when the news is revealed

The NKPC is steeper and less forward looking

- We derive the NKPC under our model of firms' beliefs,

$$\pi_t = \frac{(1 - \beta\theta_P\delta) \left(1 - \frac{\theta_P}{\delta}\right)}{\theta_P} \cdot \sum_{\tau=0}^{\infty} (\beta\delta)^\tau \mathbb{E}_t \left[\text{mc}_{t+\tau}^{\text{real}} \right] \quad \text{Myopic NKPC}$$
$$+ \frac{1 - \delta}{\delta} \cdot \text{mc}_t^{\text{real}} \quad \text{Boost as costs today observable}$$
$$+ \omega_b b_t \quad \text{Backward lookingness}$$

where b_t acts like belief-driven endogenous cost push shock

$$b_t = \tilde{\mathcal{K}} \Delta \text{mc}_t + (1 - \tilde{\mathcal{K}}) \tilde{\rho} b_{t-1}$$

and depends on *nominal* marginal cost *growth*.

The NKPC is steeper and less forward looking

- We derive the NKPC under our model of firms' beliefs.
- Fully AL ($\alpha^{\text{FIRE}} = 0$) $\implies$ microfounded Friedman-Phelps Phillips curve.
 - ▶ Allows us to calibrate with survey data, and do comparative statics.
 - ▶ More flexible prices imply steeper and more inertial Phillips curve.

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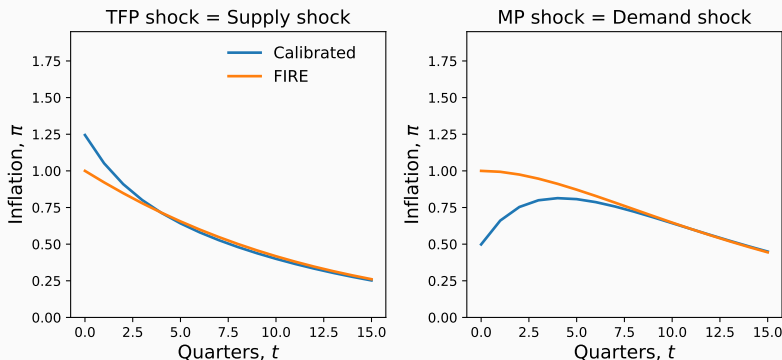
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 - ▶ Allows us to calibrate with survey data, and do comparative statics.
 - ▶ More flexible prices imply steeper and more inertial Phillips curve.
- We quantitatively predict steeper, less forward looking PC, but little inertia.
- Consistent with (Hazell, Herreño, Nakamura and Steinsson, 2022) under myopia.

NK model with Adaptive Learning

Adaptive Learning amplifies supply shocks, dampens demand shocks

In a New Keynesian model with sticky prices and wages:

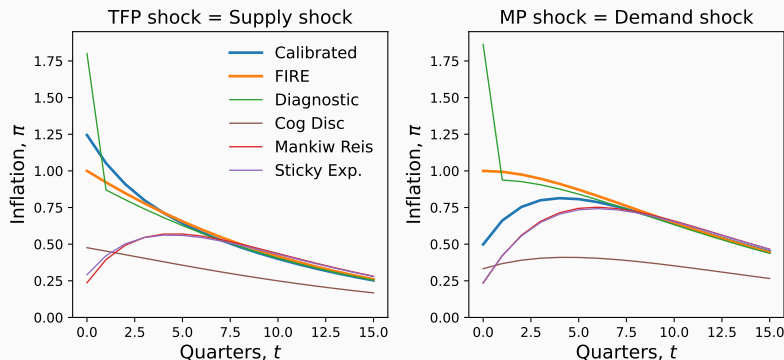
- Supply shock amplified and accelerated because costs hit quickly
- Demand shocks dampened and slowed because costs hit slowly, via sticky wages



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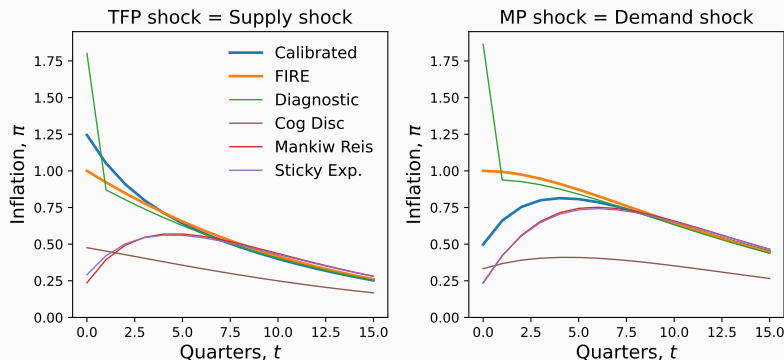
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- Find same asymmetry in estimated medium-scale NK model.

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- Forward guidance is weaker at long horizons, but stronger at short horizons.
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- Forward guidance is weaker at long horizons, but stronger at short horizons.
- Household beliefs become an even more important propagation channel.
- Incentive to act early to stop inflation embedding in expectations?
 - ▶ Exactly when Phillips curve is inertial. So not in our baseline.
 - ▶ But when prices are flexible, inflation more persistent and MP should act early.

Conclusion

- The cost channel of inflation depends on firms' own expected future costs.
- These don't seem to react to aggregate news the way CPI expectations do.
- Instead, we find firms' cost forecasts are driven in large part by past costs.
- Adaptive Learning $\implies$ Inflation responds weakly to news about future costs, but strongly once costs move.
- Supply shocks are more inflationary but demand shocks are less inflationary.

Thank you!

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