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STATE-DEPENDENT PRICING AND COST-PUSH INFLATION IN A PRODUCTION NETWORK ECONOMY
State-dependent pricing and cost-push inflation in a production network economy
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1 Introduction

Is observed inflation demand-push or cost-push? Phillips curve
\[ \hat{p} = \hat{\beta}_0 + \hat{\beta}_1 t + \hat{\epsilon}_{t+1} + \hat{\eta}_t \]

Where residual \( \hat{\eta}_t \) comes from? Sectoral shocks. (ex. Oil sector)
\( \hat{\epsilon}_{t+1} = \epsilon(\text{shocks, prod. network, price rigidity}) \)

State-dependent vs non-state-dependent price rigidity (ex. Menu-cost vs Calvo)

State-dependence = rigidity depends on shock size

NK + IO-network literature relies on non-state-dep. pricing (Erceg 2000, Aoki 2001, Rubbo 2022, La'O et al. 2022)

Yet, numerous empirical evidence of state-dep. pricing (Nakamura et al. 2008, Eichenbaum et al. 2011, Campbell et al. 2014, Carvalho et al. 2021 –)

This project: role of state-dependent pricing in shaping cost-push effect in NK IO-network model

2 Framework/Main results

NK production network model with distinctive feature: information friction resulting in state-dependent price rigidity

Main results (theoretical/empirical/quantitative)
- State-dep. may reverse the sign of cost-push effect
- 70% of US sectors have evidence of state-dep. pricing
- State-dep. affects size/sign of cost-push effect in US

3 State-dependent price rigidity

Suitable "state" variable? Sectoral marginal cost vector
\[ m_{st} = m_0 + \frac{1}{1-a} \Delta \eta_{st} \]

I define relevant state in sector \( i \) as \( \Delta \eta_{si} = \sum_j \eta_{sj} \) where \( \eta_{sj} \) elements of Leonidin inverse \( L_{ij} \), sectoral productivities

Intuition: \( z \) cares about productivity of its suppliers

Tractable state-dep. pricing: sticky information + heterogeneous inattention. Firms in sector \( i \)
- track changes in \( \Delta \eta_{si} \), that is \( \Delta \eta_{si} = \Delta \eta_{sij} - \Delta \eta_{sij} \)
- those with low inattention \( z < |\Delta \eta_{si}| \) update their info.

Price flexibility \( F_{ij} = \text{share updating info.} \)
\[ F_i(\Delta \eta_{si}) = \tilde{F}_i + f_i(t) \cdot \beta_i \cdot \text{mean}(\Delta \eta_{si}) \]

\( \tilde{F}_i \) is average price flexibility in sector \( i \)
\( f_i \) state dependency parameter

4 State-dependence estimation

Model response of prices to shocks yields \( \tilde{F}_i, f_i \) estimates

Intuition: strong average response = flexible prices; response depends on \( \Delta \eta_{si} \) = state-dependence

Data/Methodology:
- prices, wages, consumption, hours worked for \(-360 \) sectors, 80% of cons. basket, monthly freq. for US; IO-network for model calibration
- compute sectoral shocks from the model
- estimate each \( F_0, f_0 \) model-based IV regression

5 Phillips curve/decomposition

Consumer price inflation Phillips curve
\[ \hat{p}_t = \hat{\beta}_0 + \hat{\beta}_1 t + \hat{\epsilon}_{t+1} + \hat{\eta}_t \]

where \( \hat{\eta}_t \) are price gaps (efficient minus true prices)
\( \tilde{F}_i \) is diagonal matrix of sectoral flexibility \( f_i \)

Cost-push inflation decomposition
\[ \hat{\eta}_t = \hat{\delta}_1 F_m \hat{\eta}_t + \hat{\delta}_2 \tilde{F}_m \hat{\epsilon}_m + \hat{\theta}_m \tilde{F}_m \hat{\epsilon}_m \]

Cost-push decomposition
\[ \hat{\eta}_t = \hat{\eta}_t^{\text{cost}} + \hat{\eta}_t^{\text{reset}} + \hat{\eta}_t^{\text{shock}} + \hat{\eta}_t^{\text{demand}} \]

Interpretation: reset prices \( \hat{\eta}_t^{\text{reset}} = \hat{\eta}_t^{\text{reset}} + \Delta \eta_{\text{cost-push}} \), Main effect obtains if \( \hat{\eta}_t^{\text{reset}} = \hat{\eta}_t^{\text{reset}} + \Delta \eta_{\text{cost-push}} \)

6 Example: commodity shock

Two commodities: Oil, Grain (fully flexible prices)

Two final goods: FO and FG (flexibility: \( \hat{F}_0 \) \( \hat{F}_0 \))

Oil grain shocks: \( \hat{\epsilon}_{t, FO} \) \( \hat{\epsilon}_{t, FG} \)

Oil shock: \( \hat{\epsilon}_{t, FO} = \frac{1}{1-a} \Delta \eta_{t, FO} \)

Grain shock: \( \hat{\epsilon}_{t, FG} = \frac{1}{1-a} \Delta \eta_{t, FG} \)

Non-state-dep.: let \( \hat{F}_0 > \hat{F}_0 \) under neg. oil shock \( \hat{\eta}_t^{\text{cost}} > 0 \)

State-dep.: oil shock: \( \hat{F}_0 > \hat{F}_0 \) grain shock: \( \hat{F}_0 < \hat{F}_0 \)

Under neg. oil/gain shock \( \hat{\eta}_t^{\text{cost}} < 0 \)

State-dependence reverses cost-push effect!

7 Flexibility/State-dependence estimates

(a) Average price flexibility (b) State-dep. of price flexibility

Figure 1: Price flexibility/state-dependence estimates

Average price flexibility \( \hat{F}_i \) and state-dependence parameter estimates \( f_i \) across 364 sectors, sectors are weighted by consumption shares \( s_i \); variation is plotted only for 90%-level significant estimates; estimates insignificant at 90% level are forced to zero; interpretation of state-dependence parameter \( f_i \): i.e., increase in \( \Delta \eta_{si} \) above its time average leads to price flexibility increase of \( f_i \% \).

Figure 2: Link with relevant state volatility

(a) Average price flexibility (b) State-dep. of price flexibility

Average price flexibility estimates \( \hat{F}_i \) and state-dependence parameter estimates \( f_i \) are plotted against the time average volatility of sector-relevant productivity state \( \Delta \eta_{si} \); sectors are weighted by consumption shares \( s_i \); estimate insignificant at 90% level are forced to zero; linear regressions within the group of significant estimates; correlation coefficient for panel (a) is 0.44 and correlation coefficient for panel (b) is -0.25.

8 Cost-push effect in the US

Figure 3: Cost-push inflation and state-dependence pricing

Note: Grey dotted line plots observed CPI inflation.

9 Discussion

- State-dependence plays different roles in shaping cost-push inflation throughout recent history
  - amplification post-Great Recession
  - sign reversal/amplification post-Covid
- Recent high inflation in the US is only partially cost-push (demand/expectations factors might be more important)