Measuring Shortages Since 1900

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Motivation & Research Question

- Shortages: lack of sufficient supply of goods, services and factors of production to meet demand in a particular market.

- Shortages have been a recurring feature of economic life

- Limited research on their long-term evolution and effects

- Our approach:

  - Construct long-run shortage index for the United States

 - Examine its relationship with economic activity

Related Literature

- News-based indicators of shortages:
    - Lamont (1997): Hand-coded indicator using WSJ headlines
    - Chen and Houle (2023): Index for Canada since 2000
    - Burriel et al. (2023): Index for advanced economies since 2000

- Supply chain pressure measure based on transportation costs:
    - Benigno et al. (2022)

- Shortages and inflation during COVID-19 pandemic:
    - Pitschner (2022): corporate filings
    - Bernanke and Blanchard (2025): Google Trends-based shortages

- Contributions of our study:
    - First comprehensive measure of shortages spanning 125 years
    - Univariate regressions, forecasting regressions and structural VAR analysis show persistent effects of shortages on inflation
    - News about shortages combine reflect demand and supply forces as well as "exogenous" shocks

Constructing the Shortage Index

- Sample: Text of 25 million news articles from NYT, WaPo, CT, BG, LAT, WSJ, analyzed at monthly frequency (about 20,000 articles per month)

- Search query: 'shortage' words near 'topic' words (energy, food, industry, labor) + economic terms

- Index is proportional to the share of articles discussing energy, food, industry, and labor shortages each month

- Validation: Audit of articles, comparison to other shortage measures

Grouping of Articles for the Construction of the Index

All Newspaper Articles $\mathcal{A}$

Mentioning Shortages $\mathcal{B}$

Mentioning Shortages NEAR Topic Words $\mathcal{S}$
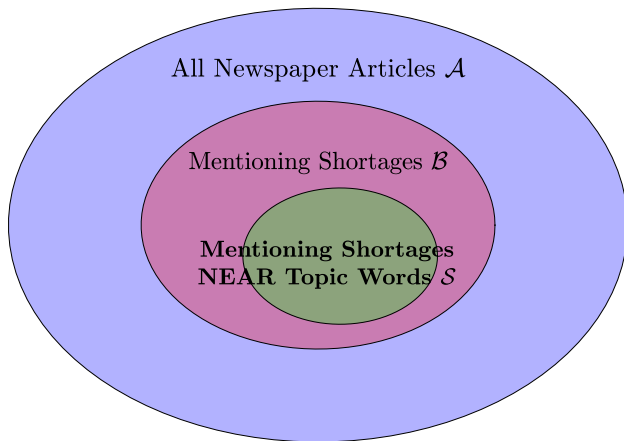
Search Query for the Shortage Index

Energy Shortages : (*shortages* N/5 *energy*) AND *economics*

Food Shortages : (*shortages* N/5 *food*) AND *economics*

Industry Shortages : (*shortages* N/5 *industry*) AND *economics*

Labor Shortages : (*shortages* N/5 *labor*) AND *economics*

shortages : shortage, bottleneck, scarcity, rationing

energy : oil, gas, coal, electricity, ...

food : food, wheat, meat, agriculture, ...

industry : steel, automotive, machinery, ...

labor : labor, workers, employment, ...

economics : economic, production, market, ...

Table: Search query and topic sets used to construct the shortage index.

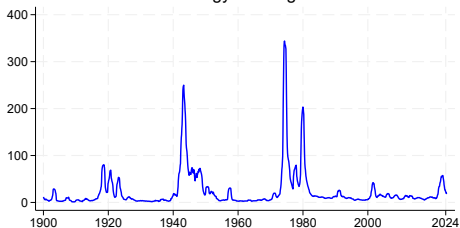# The Shortage Index, 1900-2024

Index: 1900-2019=100
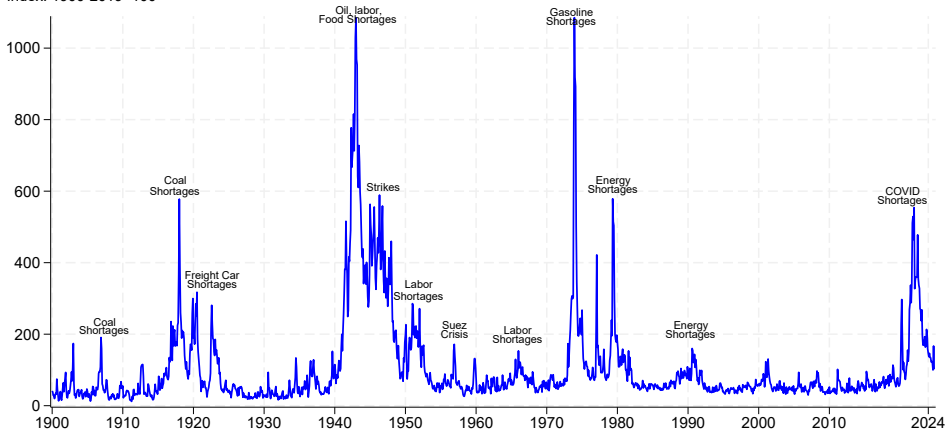
Monthly Data through November 2024.
Updated data at `https://www.matteoiacoviello.com/shortages.html`.

The Shortage Index: Decomposition by Category

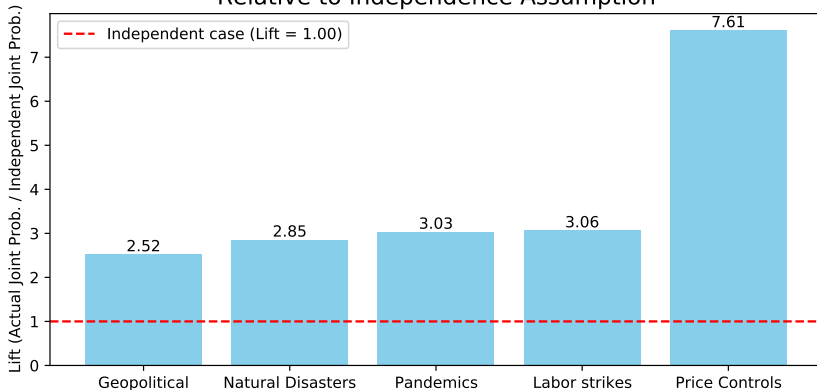12-month moving average. Scale Equal to Contribution to Total Index.

Phenomena Associated with Shortages

Comparison of Joint Probability Lifts
Relative to Independence Assumption

Category	P(Shortage)	P(Category)	P(Joint)	P(Indep.)
Geopolitical	1.27%	2.63%	0.084%	0.033%
Natural Disasters	1.27%	2.85%	0.103%	0.036%
Pandemics	1.27%	1.23%	0.047%	0.016%
Labor strikes	1.27%	2.69%	0.104%	0.034%
Price Controls	1.27%	0.80%	0.077%	0.010%

Validating the Shortage Index

Used Claude 🔗 AI assistant to perform the audit

- Extracted snippets of text from each article;
- Provided training examples to guide Claude's analysis
- Claude classified articles 1/0 and provided explanations

Sampled 872 articles included in the index

- 93.7% of articles correctly mention shortages (False positives: 6.3%) 🔗

Sampled 298 articles not included in the index

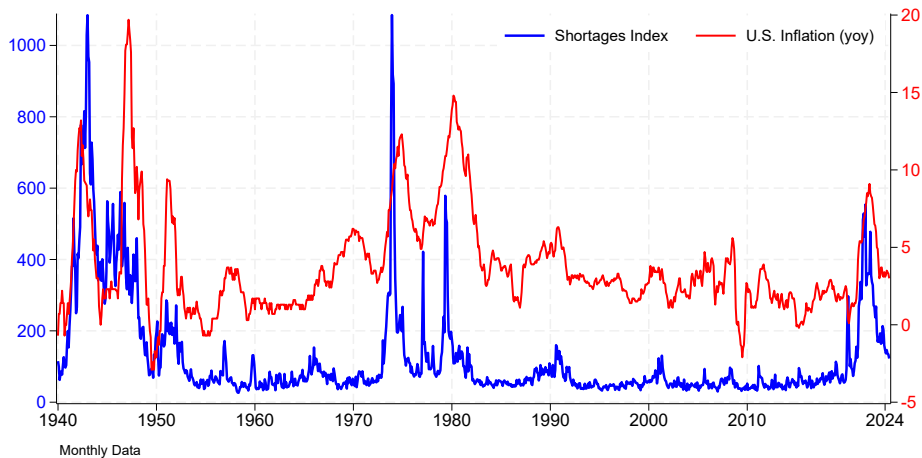- Only 1 article mentioned shortages (False negatives: 0.33%)

Proximity of shortage words to topic words improves accuracy

- Without proximity restriction, false positive rate rises to 15.8%

Comparison to Other Measures (starting after 1975)

All Indexes Standardized to have zero mean and unit standard deviation over 2000-2023 Period
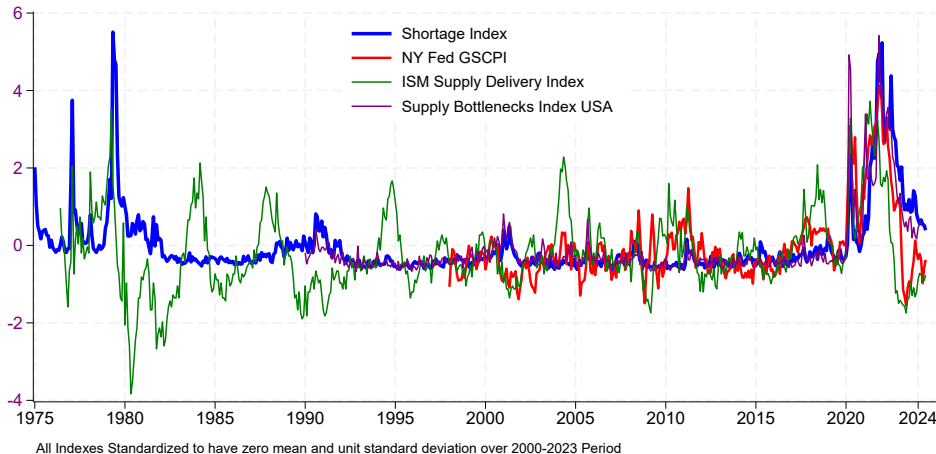
Economic Effects: Shortages and U.S. Inflation

Monthly Data

Predictive Regressions

- Rolling regressions:

$$\Delta Y_{t+h} = \alpha + \beta \text{ SHORTAGE}_t + \Sigma_{i=0}^{p}\mathbf{X}_{t-p} + \varepsilon_{t+h}$$

where:

- ΔY_{t+h}: change in real pc GDP, or GDP deflator between t and $t+h$

- SHORTAGE$_t$: shortage index at time t

- **X**: control variables

- Results robust to controls (oil, commodities, wages, inflation expectations)

Effects vary over time.

Generally positive for inflation, negative for activity.
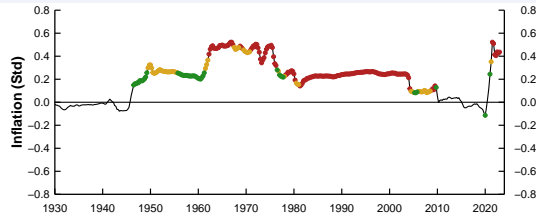
Figure: Effect of Shortages on GDP Deflator (30-Year Window)
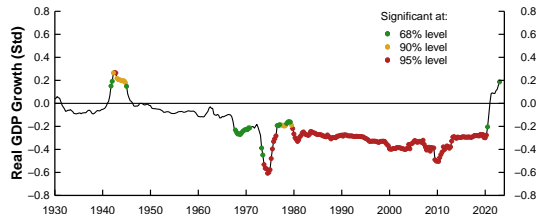
Figure: Effect of Shortages on Real GDP (30-Year Window)

Can Shortages Help Forecasting Inflation?

Forecasting Model for 3-month ahead, 12-month inflation:

$$\pi_{t+3} = c + \beta\pi_t + \gamma u_t + \delta o_t + \zeta S_t$$

- π_t: 12-month CPI inflation
- u_t: Unemployment (3-mo MA)
- o_t: 12-mo. change in oil prices (3-mo MA)
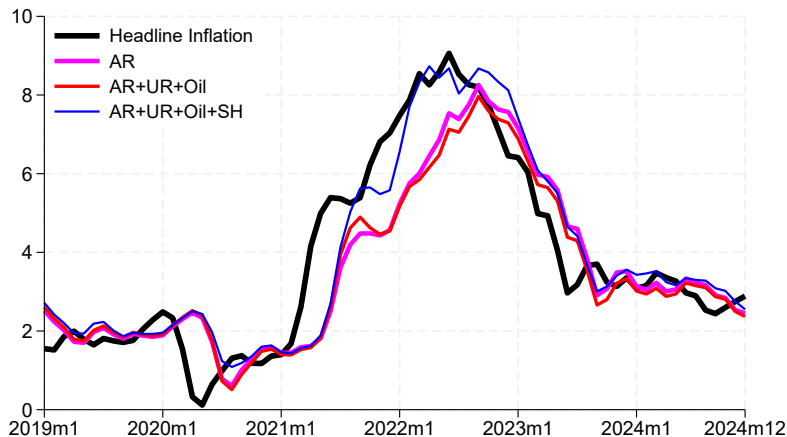- S_t: Shortage Index (3-mo MA)

Methodology:
- Rolling forecasts: 1990:M1 - 2024:M9
- Start in 1960:M1. 30-year fixed windows

Results:
- Shortages model (S) outperforms no-shortages (NS) and AR model (AR)
- 1990-2024: RMSE 0.86 (S) vs 0.92 (NS) vs 0.89 (AR) ↓ 6.5%
- 2020-2024: RMSE 1.04 (S) vs 1.31 (NS) vs 1.31 (AR) ↓ 20.6%

Forecast Comparison around the Pandemic

Each month plots actual inflation against the expectation calculated 3 months before for the same period

Model with shortages better predicts inflation in 2022-23

VAR Analysis: Setup

Structural VAR to identify causes and consequences of shortages.

$$\pi = b_\pi(L)\mathbf{X}_{-1} + \kappa y + u^S$$
$$y = b_y(L)\mathbf{X}_{-1} - \delta\pi + u^D$$
$$c = b_c(L)\mathbf{X}_{-1} + \phi_D u^D + \phi_S u^S + u^C$$
$$h = b_h(L)\mathbf{X}_{-1} + \theta_S u^S + \theta_D u^D + \theta_C u^C + u^H$$
$$r = b_r(L)\mathbf{X}_{-1} + \alpha_\pi\pi + \alpha_Y y + \alpha_H h + \alpha_C c + u^R$$

where $\mathbf{X}_t = (y_t, \pi_t, c_t, h_t, r_t)'$ and:

- y: 4-quarter per capita GDP growth
- π: 4-quarter % change CPI
- c: 4-quarter % change in commodity prices
- h: shortages
- r: 3-month interest rate
- u^S, u^D, u^C, u^H, u^R : shocks

VAR Analysis: Identification

$$\pi = \kappa y + u^S$$
$$y = -\delta \pi + u^D$$
$$c = \phi_D u^D + \phi_S u^S + u^C$$
$$h = \theta_S u^S + \theta_D u^D + \theta_C u^C + u^H$$
$$r = \alpha_\pi \pi + \alpha_Y y + \alpha_H h + \alpha_C c + u^R$$

- System above is under-identified (would be just-identified if κ was known and other parameters were unrestricted)

- To aid identification, we impose priors as in Baumeister and Hamilton (2019) priors
  - Restrict κ, δ to be positive
  - Restrict $\theta_S, \theta_D, \theta_C$ (and ϕ_D, ϕ_S) to be positive
  - Restrict α_π, α_Y to be positive
  - Estimate VAR with standard Bayesian methods posteriors

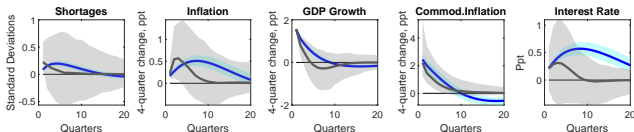# Impulse Responses
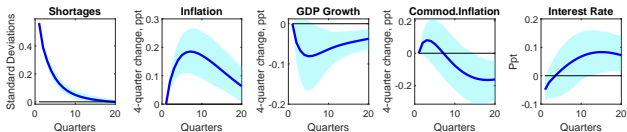
Shortages Shocks
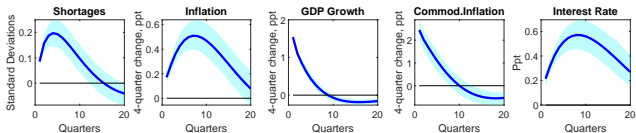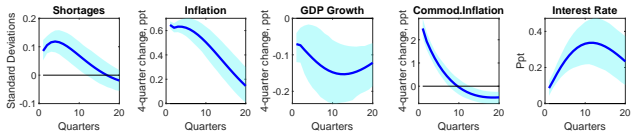
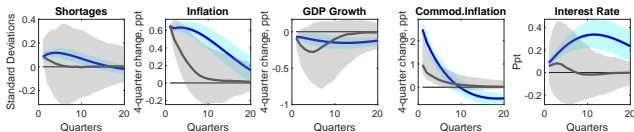Demand Shocks

Supply Shocks

Impulse Responses, Prior vs Posterior
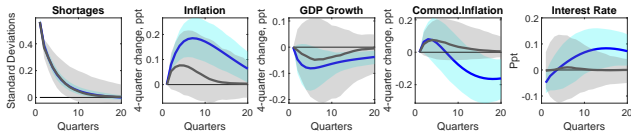

Shortages Shocks



Demand Shocks

Supply Shocks

What are Shortage Shocks?

- Fluctuations in shortages reflect:
    - Business cycle-induced movements (supply, demand, commodities)
    - Exogenous shocks (major disruptions to flow of goods, services, and factors of production)
        - Atypical adjustment to sudden shifts in economic conditions, e.g.: demand reallocation causing temporary bottlenecks
        - Geopolitical shocks slowing flow of goods
        - Surge in demand causing rationing when social norms prevent large price adjustments
        - Shocks to regulation (price ceilings, quantity rationing)
- Assumption: All 'exogenous' shortage shocks have same effects

Historical Decomposition: Full Sample
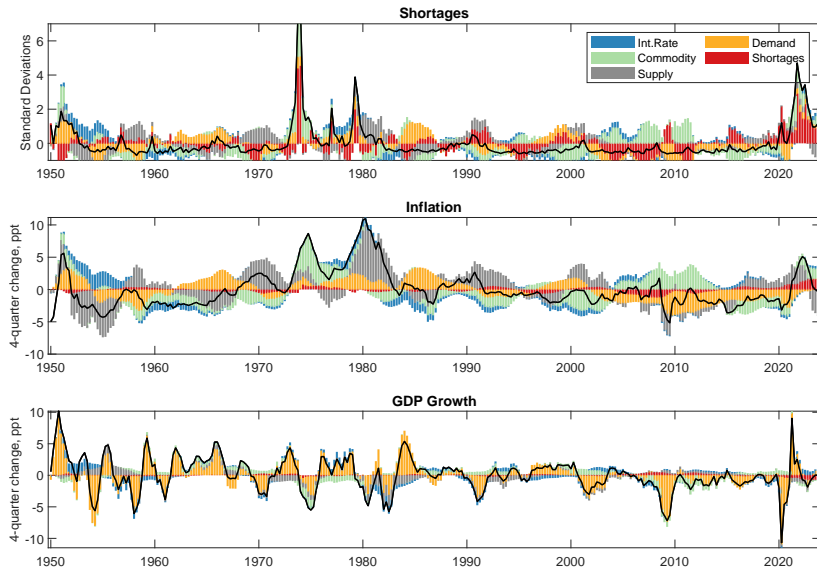
Historical Decomposition: 2020-Present
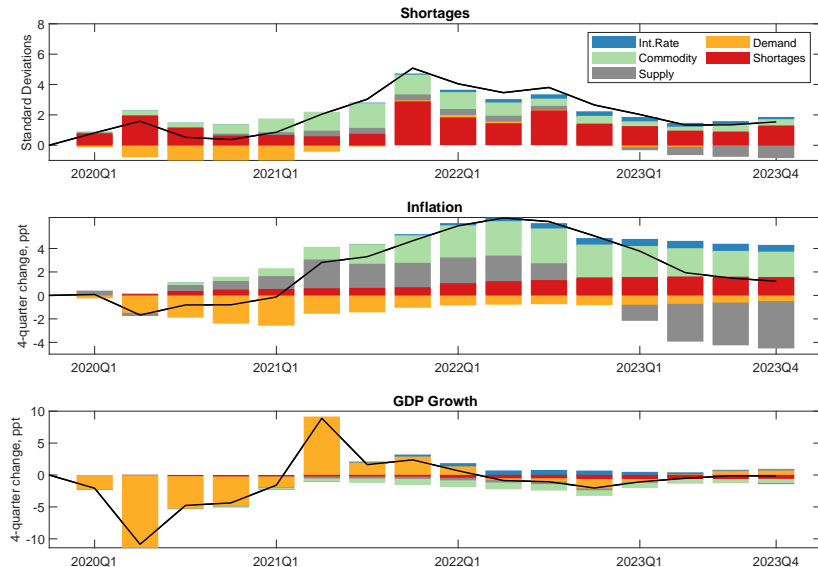
Summary & Implications

- New long-run shortage index captures historical trends

- Shortages reflect both supply and demand forces, with relative importance varying over time

- Shortages have persistent inflationary effects

- Index provides new tool for researchers and policymakers to understand shortage dynamics

APPENDIX

Validating the Index: Prompt

Prompt for Claude AI

"I give you 872 snippets of text each about 110 characters long. For each of them, can you tell me whether they mention current or perspective shortages or rationing or scarcity or bottlenecks related to goods, labor, materials, food, water? Just return a table with yes=1, no=0, unsure=99, and a brief explanation.

For instance.

Article 1 mentions that steel shortages will prevail in the near future, so it is a

1.

Article 2 says steel shortages caused a plant closure, so it is coded 1.

Article 329 says no shortage of cars has been experienced, so 0."

Back

Validating the Index: Outcome

Articles coded as mentioning Shortages

"strike caused steel shortages are beginning to hit general motors corp. so.."

Claude: 1: Steel shortages are hitting General Motors

"canada s action today in temporarily suspending meat rationing.."

Claude: 0: Canada temporarily suspending meat rationing

Article coded as NOT mentioning Shortages

Claude: 1: Mentions recycling of newsprint was held back by a shortage of de-inking plants

Note

Back

Priors: Baseline Model

Back

Construction
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Effects
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Appendix
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References
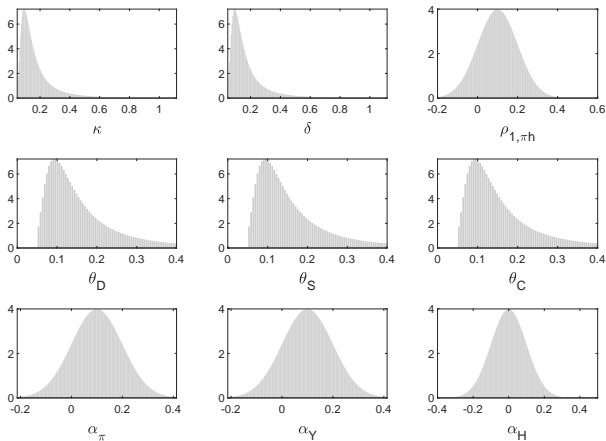
Priors and Posteriors: Baseline Model

Construction
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Effects
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Appendix
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References
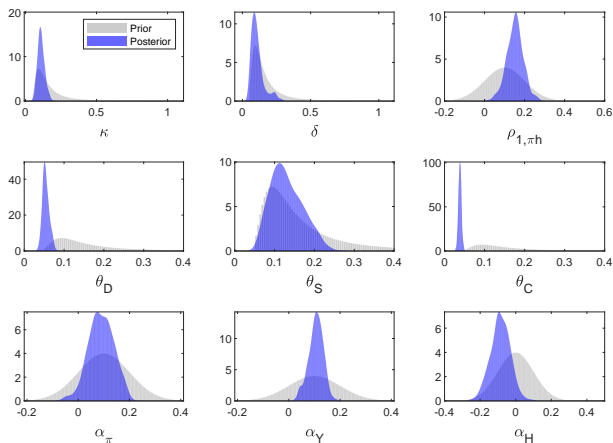
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