Measuring Shortages Since 1900

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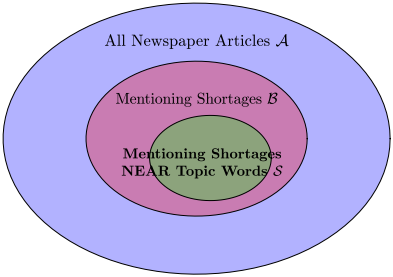
Motivation & Research Question

- 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—global and for six advanced economies
  - Examine its relationship with economic activity

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)
- Query: 'shortage' N/5 '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



Search Query for the Shortage Index

Query Structure: (*shortages* N/5 *topic*) AND *economics*

Four Categories:

- **Energy** Shortages
- **Food** Shortages
- **Industry** Shortages
- **Labor** Shortages

Keywords:

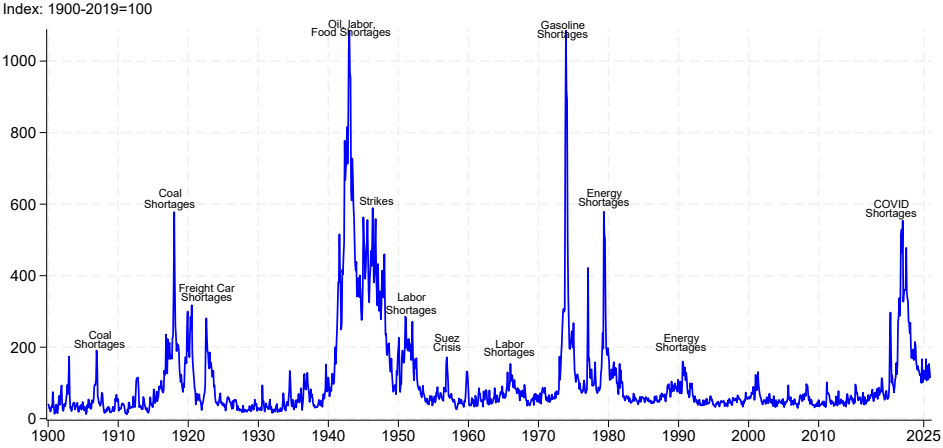
- *shortages*: shortage, bottleneck, scarcity, rationing
- *economics*: economic, production, market, ...

Topic Words:

- *energy*: oil, gas, coal, electricity
- *food*: wheat, meat, agriculture
- *industry*: steel, automotive, machinery
- *labor*: workers, employment

N/5: Shortage and topic words must appear within 5 words of each other

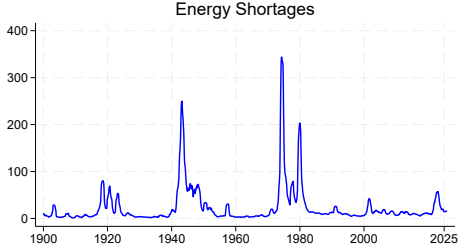
The Shortage Index, 1900-2025



Monthly Data through December 2025.

Updated data at `https://www.matteoiacoviello.com/shortages.html`.

The Shortage Index by Topic



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

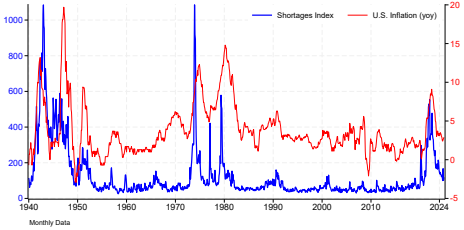
Top Events Associated with Shortages

Likelihood of Co-occurrence with Shortages, based on further textual analysis of newspaper articles mentioning shortages

1. **Price Controls**	**7.6x more likely**
2. **Labor Strikes**	**3.1x more likely**
3. **Pandemics**	**3.0x more likely**
4. **Natural Disasters**	**2.9x more likely**
5. **Adverse Geopolitical Events**	**2.5x more likely**

Compared to what one would expect if events were independent

Shortages and Economic Activity



Three exercises:

- 1. Rolling Predictive Regressions (one chart - see paper for more)
- 2. Forecasting Exercise (one chart - see paper for more)
- 3. VAR Analysis

1. Predicted Effects of Shortages on Inflation and GDP

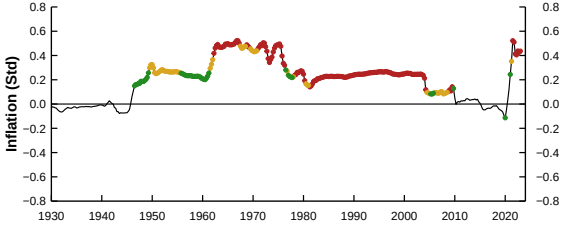


Figure: Effect on 1-year ahead GDP Deflator (30-Year Window)

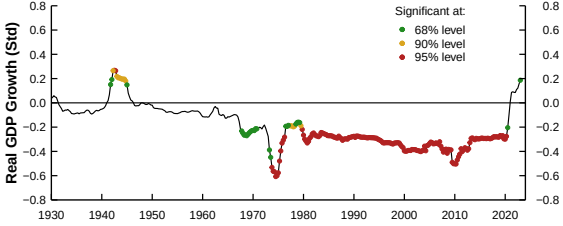
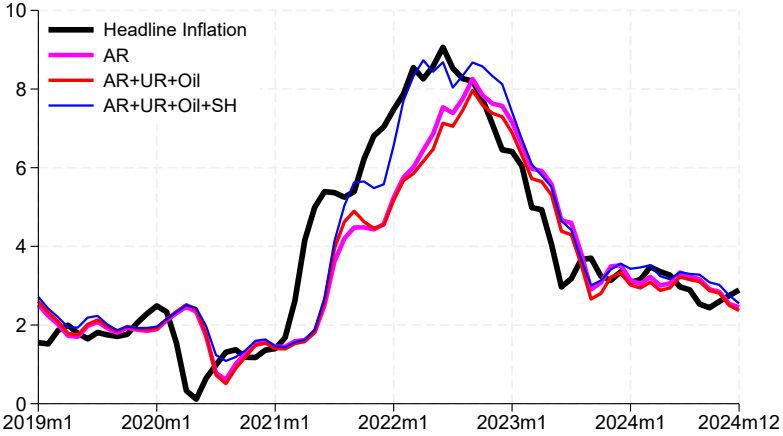


Figure: Effect on 1-year ahead Real GDP (30-Year Window)

2. 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 - 1950:Q1-2024:Q4

Key feature: Shortages as wedge between demand and supply

$$\boxed{\alpha h_t = d_t - y_t}$$

When shortages (h_t) are large: demand (d_t) > output (y_t) (α: scaling factor).

Embed this into Macro VAR with activity and inflation:

$$\begin{aligned} \pi &= [\mathbf{b}^S]' \mathbf{z}_{t-1} + \kappa y + u^S \\ d = y + \alpha h &= [\mathbf{b}^D]' \mathbf{z}_{t-1} - \delta \pi + u^D \\ h &= [\mathbf{b}^H]' \mathbf{z}_{t-1} + \phi_S u^S + \phi_D u^D + u^H \end{aligned}$$

where $\mathbf{z}_{t-1} = (\mathbf{X}'_{t-1}, \mathbf{X}'_{t-2}, \ldots, \mathbf{X}'_{t-p})'$ and $\mathbf{X}_t = (\pi_t, y_t, h_t)'$.

- y: realized output (4-quarter % change, GDP);
  π: inflation (4-quarter % change, CPI);
  h: shortage index.
- shocks u^S, u^D, u^H: supply, demand, shortage shock

VAR Analysis: Identification

$$\pi = \kappa y + u^S$$
$$y + \alpha h = -\delta \pi + u^D$$
$$h = \phi_S u^S + \phi_D u^D + u^H$$

- Structural parameters $(\kappa, \alpha, \delta, \phi_S, \phi_D)$ enter nonlinearly in impact matrix; identification requires restrictions beyond covariance structure
- We discipline identification using sign restrictions following Baumeister and Hamilton (2019) priors
  - $\alpha > 0$: shortages increase when demand rises relative to supply
  - $\kappa > 0$, $\delta > 0$: upward-sloping supply, downward-sloping demand
  - $\phi_S > 0$, $\phi_D > 0$: shortages rise when supply drops, or demand rises

posteriors identification

Intuition: The Shortage Shock (u^H)

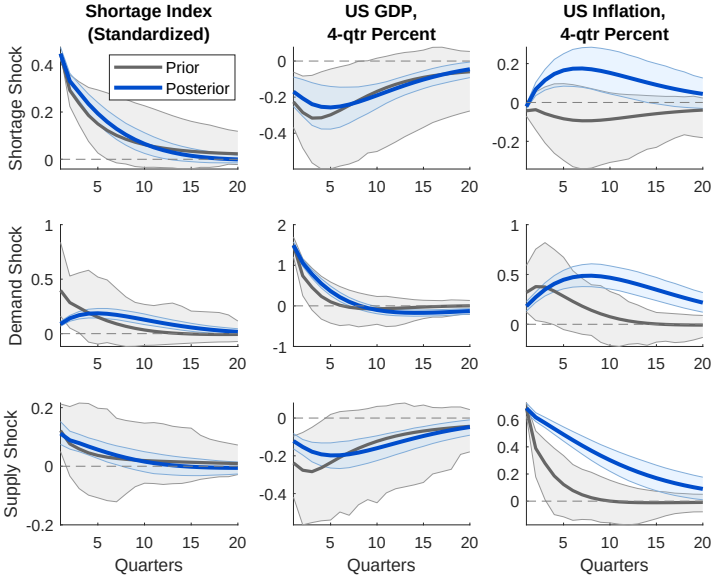
Standard shocks in demand-supply framework:

- Demand shock: Price and Quantity rise
- Supply shock: Price rises, Quantity falls

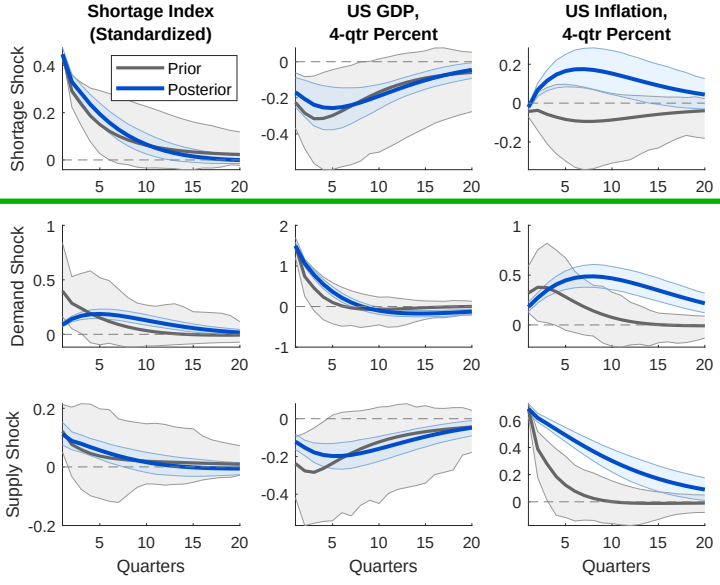
Shortage shock (u^H): larger gap between demand and supply

- Potential supply and desired demand remain unchanged
- Economy's ability to "match" the two is impaired
- Result: increases shortage wedge h_t; realized output falls
- Inflation effect unclear *ex ante*: depends on whether shortage wedge or realized output matters more for price setting

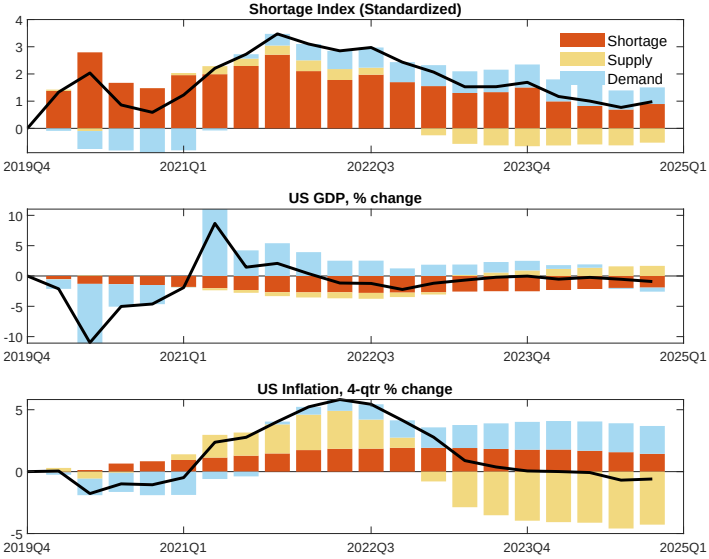
Impulse Responses



Impulse Responses



Historical Decomposition: 2020-Present



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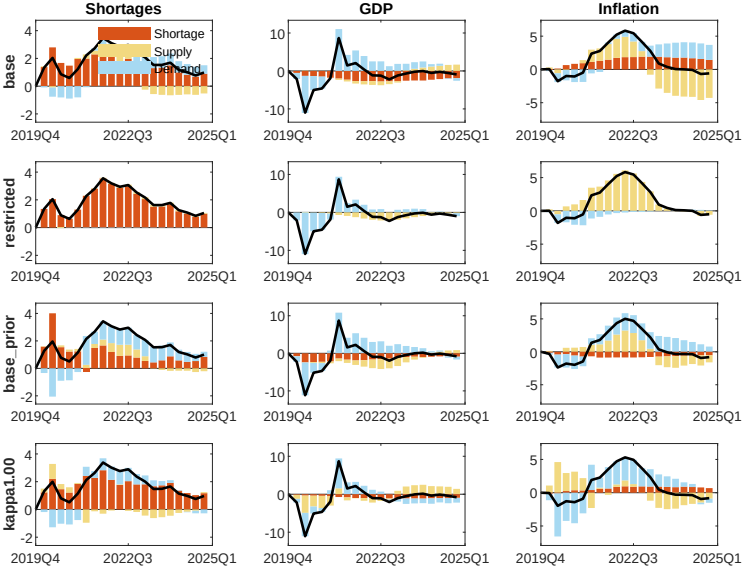
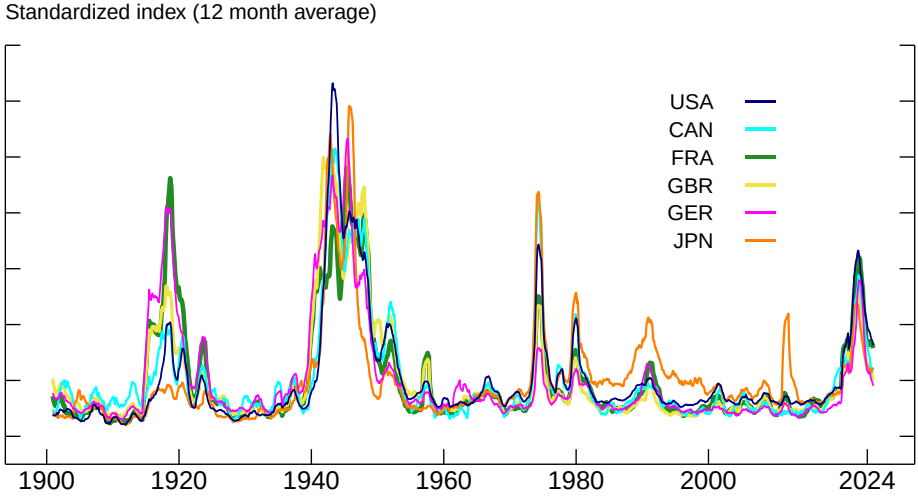


Summary

- New long-run shortage index well captures historical trends
- Shortages shocks can have persistent inflationary effects, but are less inflationary than a typical supply shock for given drop in output.
- Index provides new tool for researchers and policymakers to understand shortage dynamics

APPENDIX

Shortage Indexes by Country



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%

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

Steel Shortages To Hit GM Plants If Strike Goes On: A
A WALL STREET JOURNAL News Roundup
Wall Street Journal (1923-); Sep 21, 1959; ProQuest Historical Ne
pg. 3

Steel Shortages To Hit GM Plants If Strike Goes On

Auto Maker Faces Shutdown In Month; Others Said to Have Adequate Steel

First Closings Due in 10 Days

A WALL STREET JOURNAL News Roundup

Strike-caused steel shortages are beginning to hit General Motors Corp.

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

Claude: 1: Steel shortages are hitting General Motors

Canada Suspends Meat Rationing: OPA Cuts Pork and Beef Points for U. S.
Daily Boston Globe (1928-1960); Mar 1, 1944; ProQuest Historical Newspapers: The Boston Globe
pg. 1

Canada Suspends Meat Rationing

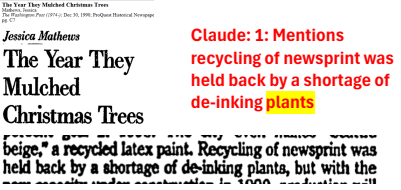
OPA Cuts Pork and Beef Points for U. S.

WASHINGTON, Feb. 29 (AP)—[watch. Canada's action today in] The OPA slashed ration costs of [temporarily suspending meat ra]tion pork and several beef cuts, but cautione

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

Claude: 0: Canada temporarily suspending meat rationing

Article coded as NOT mentioning Shortages



The Year They Mulched Christmas Trees
Mathews, Jessica
Los Angeles Post (1974-); Dec 20, 1980; ProQuest Historical Newspap
pg. C7

Jessica Mathews

The Year They Mulched Christmas Trees

beige," a recycled latex paint. Recycling of newsprint was held back by a shortage of de-inking plants, but with the

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

Note

Brighten Up Indoors With Colorful Plants
JOEL RAPP SPECIAL TO THE TIMES
Los Angeles Times (1996-); Feb 4, 1996; ProQuest Historical Newspapers: Los Angeles Times
pg. K1

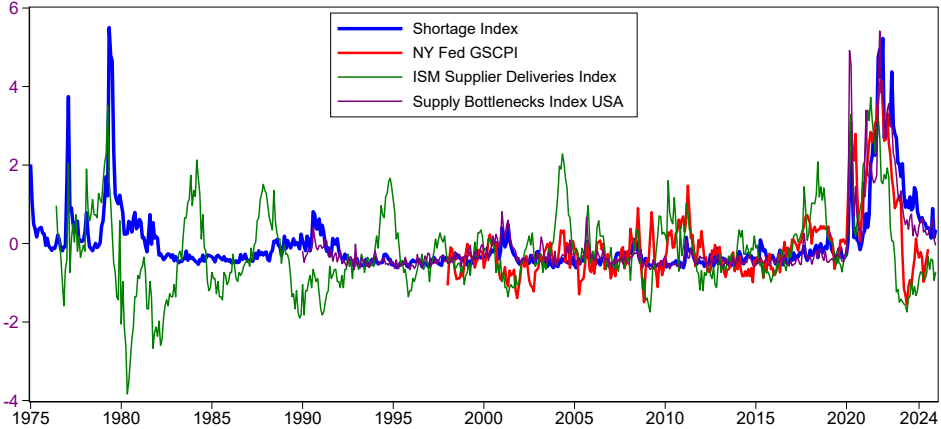
Brighten Up Indoors With Colorful Plants

There's no shortage of plants with brightly colored foliage to liven up your kitchen, living room or den during the dark days of winter, either.

Choose from an endless variety

Back

Comparison to Other Measures (starting after 1975)



All Indexes Standardized to have zero mean and unit standard deviation over 2000-2023 Period

1. Predictive Regressions

- Rolling regressions:

$$\Delta Y_{t+h} = \alpha + \beta\, SHORTAGE_t + \sum_{i=0}^{p} \gamma_i' \mathbf{X}_{t-i} + \varepsilon_{t+h}$$

where:

- ΔY_{t+h}: change in real pc GDP, or GDP deflator between t and $t+h$
- SHORTAGE$_t$: shortage index at time t
- $\mathbf{X}$: control variables (oil, commodities, wages, inflation expectations)

Effects allowed to vary over time.

Effects mostly positive for inflation, negative for activity.

2. Can Shortages Help Forecasting Inflation?

Forecasting Model for 3-month ahead, 12-month inflation π_{t+3}:

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

- 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)

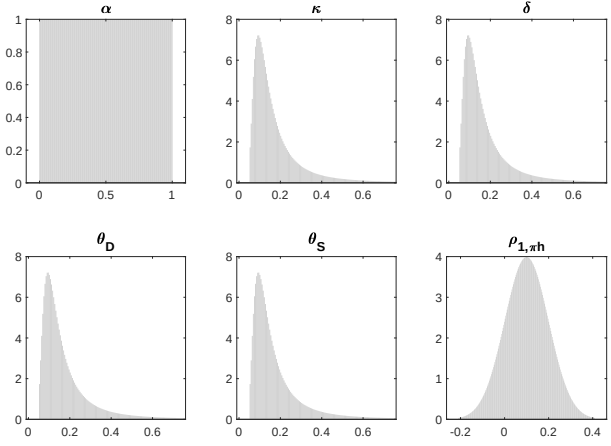
Methodology:

- 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) $\downarrow$ 6.5%
- 2020-2024: RMSE 1.04 (S) vs 1.31 (NS) vs 1.31 (AR) $\downarrow$ 20.6%

Priors: Baseline Model



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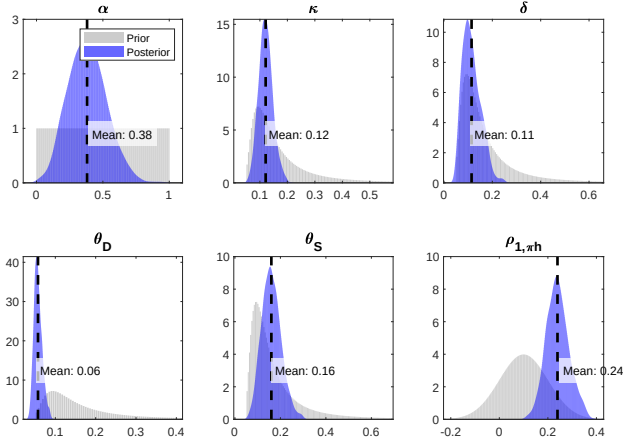
Priors and Posteriors: Baseline Model



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Identification of the Shortage VAR

1. The Information Budget (Under-identification)

The reduced-form covariance matrix Σ provides **6 unique moments**. We have **8 unknown parameters**:

$$\Theta = \{\kappa, \alpha, \delta, \phi_d, \phi_s, \sigma^2_{u^s}, \sigma^2_{u^d}, \sigma^2_{u^h}\}$$

2. Identification via Bayesian Priors

Because the unknowns outnumber the moments, the model is globally under-identified. However, identification is achieved by:

- **Informative Priors:** Following BH(2015), we incorporate external information on the supply slope (κ) and shortage scaling (α) and δ.
- **Nonlinear Updating:** Even with 8 parameters, the data updates the joint posterior as long as the structural shocks produce unique comovement pattern among variables.

3. Result: The posterior reflects a combination of the researcher's prior beliefs and the empirical correlations. While the data cannot uniquely pin down all 8 parameters, it restricts the set of economically plausible values.

Historical Decomposition: Full Sample