

Measuring Shortages Since 1900

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June 2025

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

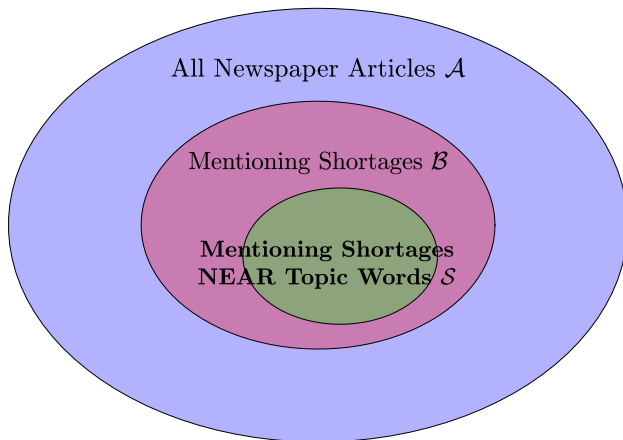
Related Literature and our Contribution

- 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 (2023): Google Trends-based shortages
- **Our Contribution:**
 - 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



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, ...

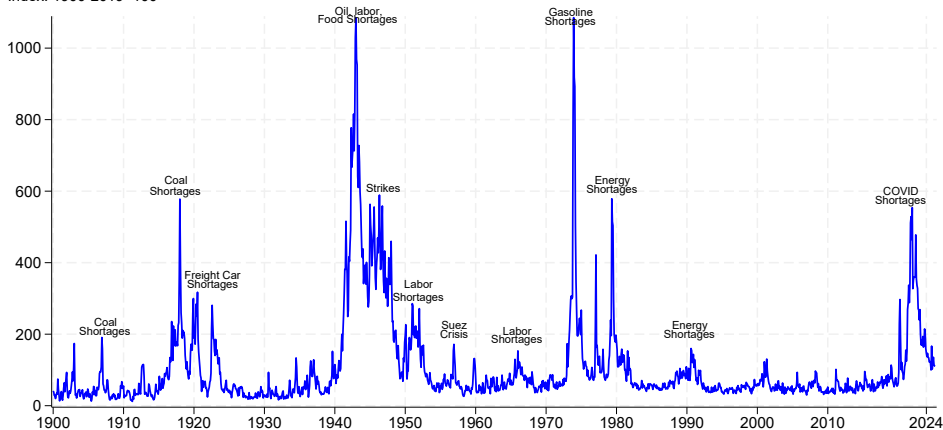
labor : labor, workers, employment, ...

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

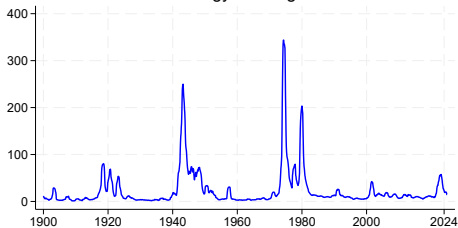


Monthly Data through April 2025.

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

The Shortage Index: Decomposition by Category

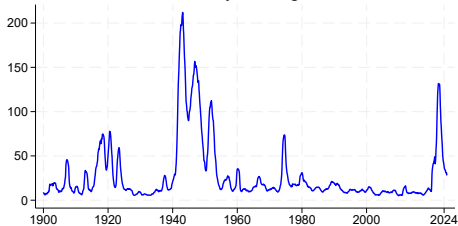
Energy Shortages



Food Shortages



Industry Shortages

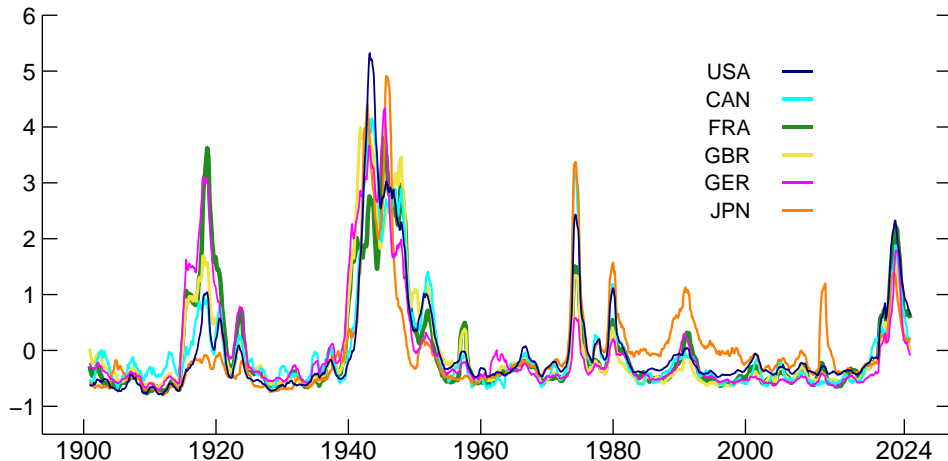


Labor Shortages



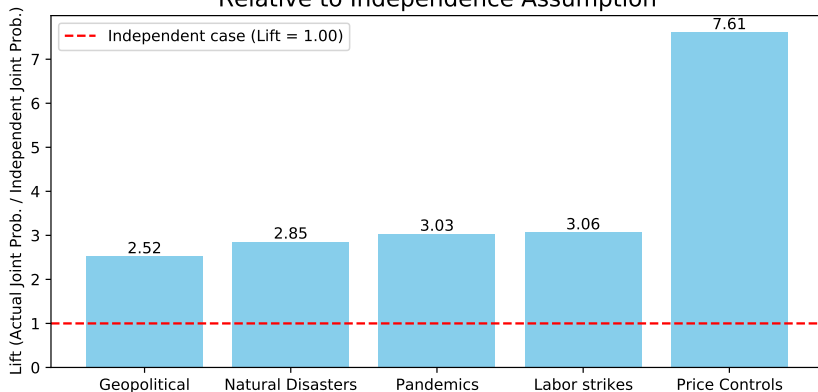
Shortage Indexes by Country

Standardized index (12 month average)





Phenomena Associated with Shortages

Comparison of Joint Probability Lifts
Relative to Independence Assumption

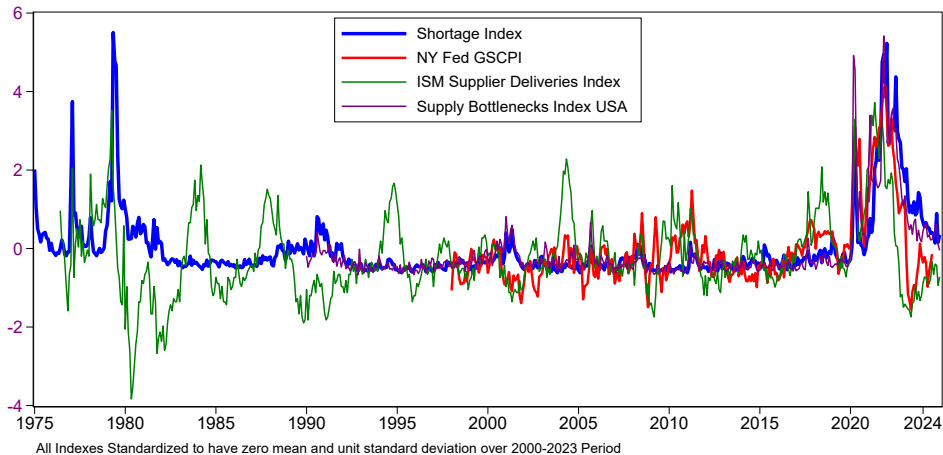


Category	P(Shortage)	P(Category)	P(Joint)	P(Indep.)
Geopolitical	1.27%	2.63%	0.084%	0.033%
Natural Disasters	1.27%	2.85%	0.103%	0.036%
Pandemics	1.27%	1.23%	0.047%	0.016%
Labor strikes	1.27%	2.69%	0.104%	0.034%
Price Controls	1.27%	0.80%	0.077%	0.010%

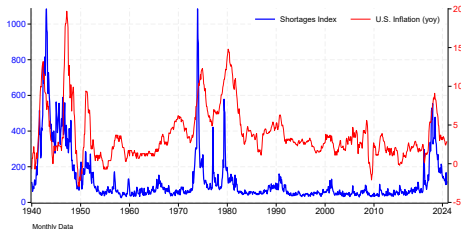
Validating the Shortage Index

- 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)



Shortages and Economic Activity



Will show three exercises:

- 1. Predictive Regressions
- 2. Forecasting Exercise
- 3. VAR Analysis

1. Predictive Regressions

- Rolling regressions:

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

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.

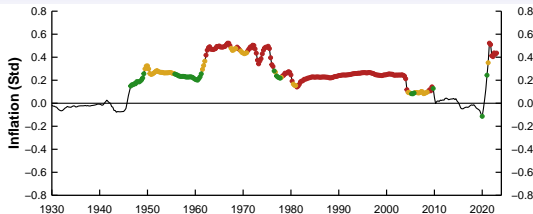


Figure: Effect of Shortages on 1-year ahead GDP Deflator (30-Year Window)

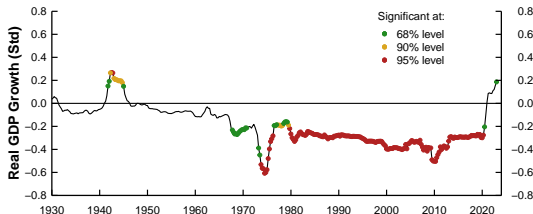


Figure: Effect of Shortages on 1-year ahead Real GDP (30-Year Window)

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)

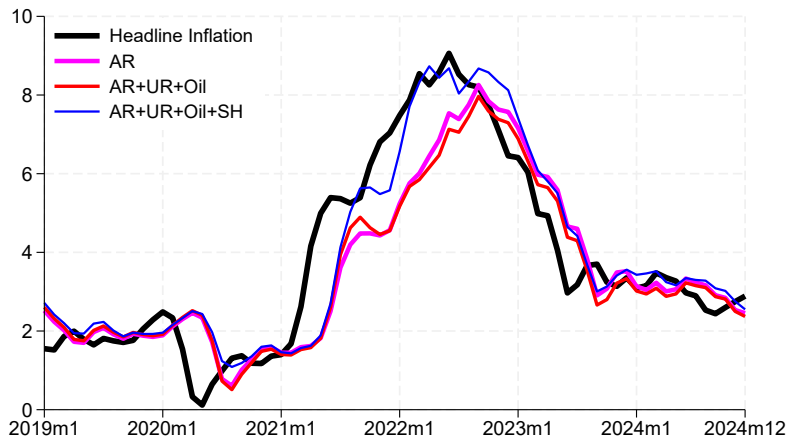
Methodology:

- 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) ↓ 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

3. VAR Analysis

Structural VAR to identify causes and consequences of shortages.

$$\pi = [\mathbf{b}^S]' \mathbf{z}_{t-1} + \kappa y + u^S$$

$$y = [\mathbf{b}^D]' \mathbf{z}_{t-1} - \delta \pi + u^D$$

$$h = [\mathbf{b}^H]' \mathbf{z}_{t-1} + \theta_S u^S + \theta_D u^D + u^H$$

$$c = [\mathbf{b}^C]' \mathbf{z}_{t-1} + \chi_D u^D + \chi_S u^S + \chi_H u^H + u^C$$

$$r = [\mathbf{b}^R]' \mathbf{z}_{t-1} + \alpha_\pi \pi + \alpha_Y y + \alpha_H h + \alpha_C c + u^R$$

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

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

VAR Analysis: Identification

$$\pi = \kappa y + u^S$$

$$y = -\delta \pi + u^D$$

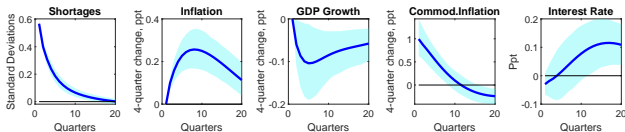
$$h = \theta_S u^S + \theta_D u^D + u^H$$

$$c = \chi_D u^D + \chi_S u^S + \chi_H u^H + u^C$$

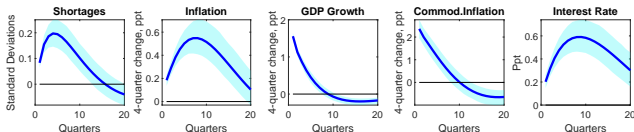
$$r = \alpha_\pi \pi + \alpha_Y y + \alpha_H h + \alpha_C c + u^R$$

- 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 θ_S, θ_D (and χ_D, χ_S, χ_H) to be positive
 - Restrict α_π, α_Y to be positive
 - Estimate VAR with Bayesian methods (and with Dynare) posteriors

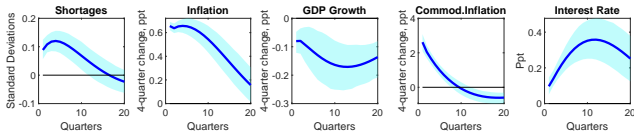
Impulse Responses



Shortages Shocks

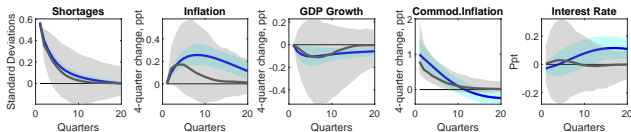


Demand Shocks

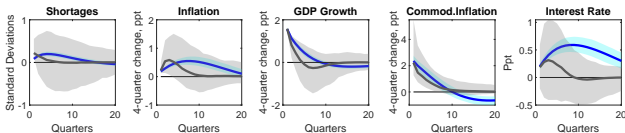


Supply Shocks

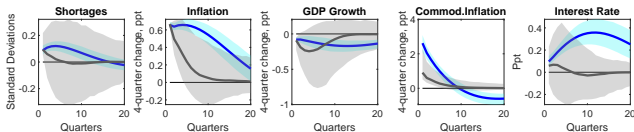
Impulse Responses, Prior vs Posterior



Shortages Shocks



Demand Shocks

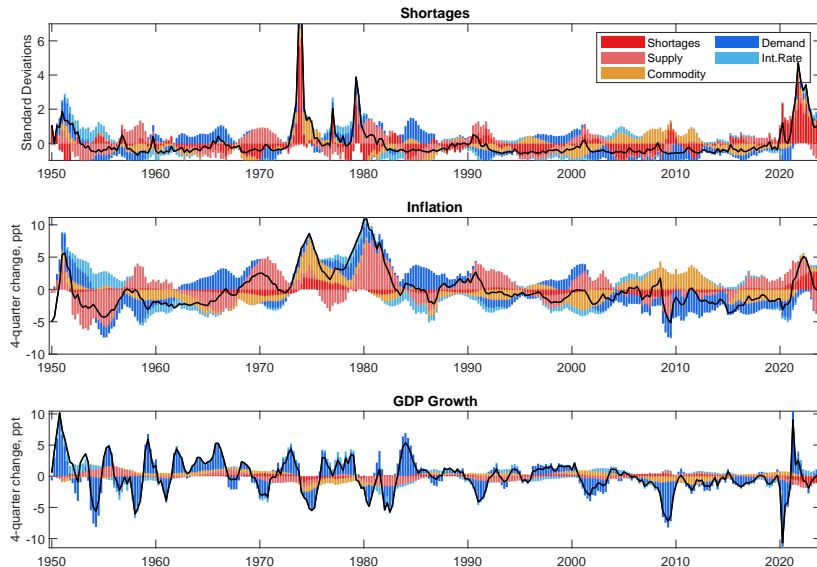


Supply Shocks

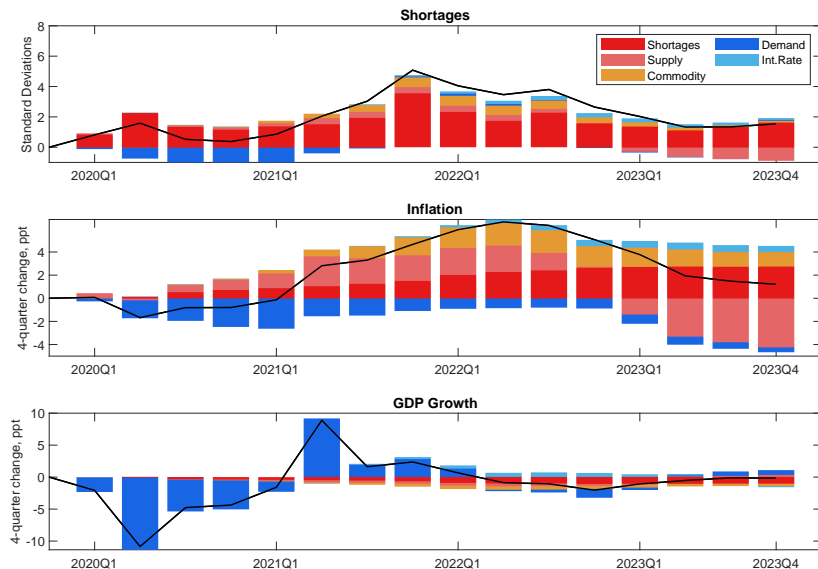
What are Shortage Shocks?

- Fluctuations in shortages reflect:
 - Business cycle-induced movements (supply, demand, commodities)
 - Exogenous Shortage 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, trade 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
- Result: Shortage shocks relative more 'contractionary' and less 'inflationary' than a typical supply shock

Historical Decomposition: Full Sample

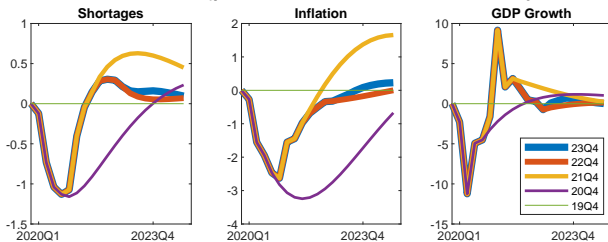


Historical Decomposition: 2020-Present

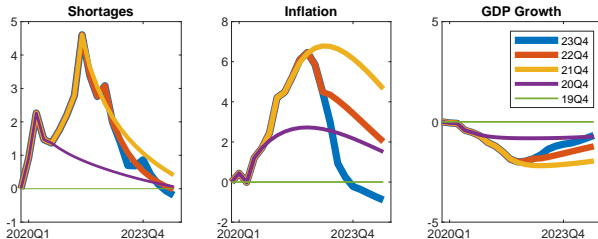


Demand-side and Supply-side Forces: '20-'24

Demand Shocks (pure demand + monetary shock)



Supply Shocks



Summary & Implications

- New long-run shortage index captures historical trends
- Shortages reflect both supply and demand forces, with relative importance varying over time
- Shortages shocks can have persistent inflationary effects, but are relatively less inflationary than a typical supply shock
- 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."

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 Newspapers
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 (1928-1980): Mar 1, 1946, 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)——bush Canada's action today in
The OPA slashed ration costs of temporarily suspending meat ra-
tion and several beef cuts, but dining.

“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
The Washington Post (1974-): Dec 30, 1990, ProQuest Historical Newspapers
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
new capacity under construction in 1990, production will

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

Note

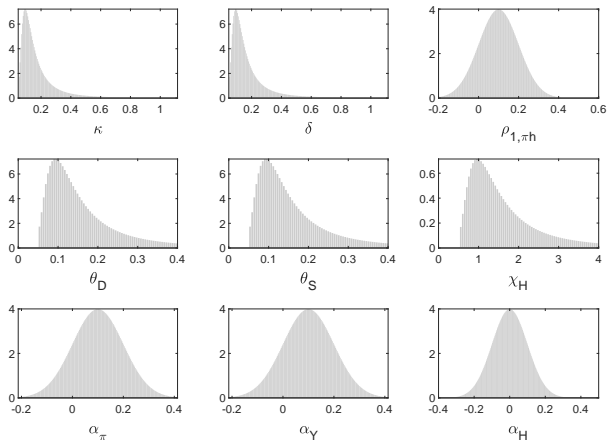
Brighten Up Indoors With Colorful Plants
JOEL RAPP SPECIAL TO THE TIMES
Los Angeles Times (1996-): Feb 4, 1996, ProQuest Historical Newspapers: Los Angeles Times
pg. K1

Brighten Up Indoors With Colorful Plants

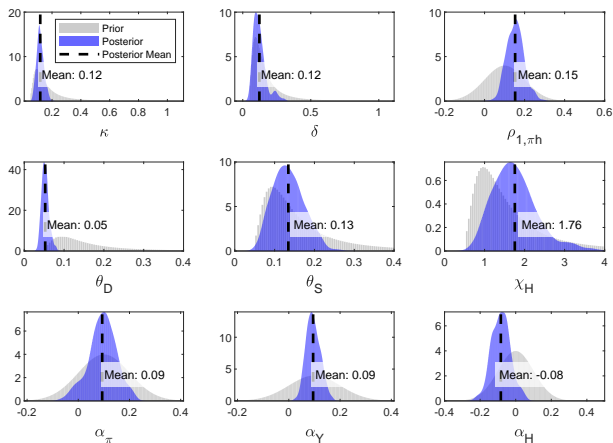
There's no shortage of plants
with brightly colored foliage to
liven up your kitchen, living room
or den during the dark days of
winter, either.

Choose from an endless variety

Priors: Baseline Model



Priors and Posteriors: Baseline Model



- Baumeister, C. and Hamilton, J. D. (2019). Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. *American Economic Review*, 109(5):1873–1910.
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- Burriel, P., Kataryniuk, I., Moreno Pérez, C., and Viani, F. (2023). A new supply bottlenecks index based on newspaper data. *Banco de Espana Working Paper*.
- Chen, L. and Houle, S. (2023). Turning words into numbers: Measuring news media coverage of shortages. Technical report, Bank of Canada.
- Lamont, O. (1997). Do shortages cause inflation? In *Reducing Inflation: Motivation and Strategy*, pages 281–306. University of Chicago Press.
- Pitschner, S. (2022). Supply chain disruptions and labor shortages: Covid in perspective. *Economics Letters*, 221:110895.