

How Do Supply Chain Pressures Affect Monetary Policy Transmission?

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Navigating Supply Chain Pressures

“**Supply constraints** have been larger and **longer lasting** than anticipated. (...) **Our policy will adapt—and has already adapted.**”

- *Chair Powell's Press Conference, November 3, 2021*

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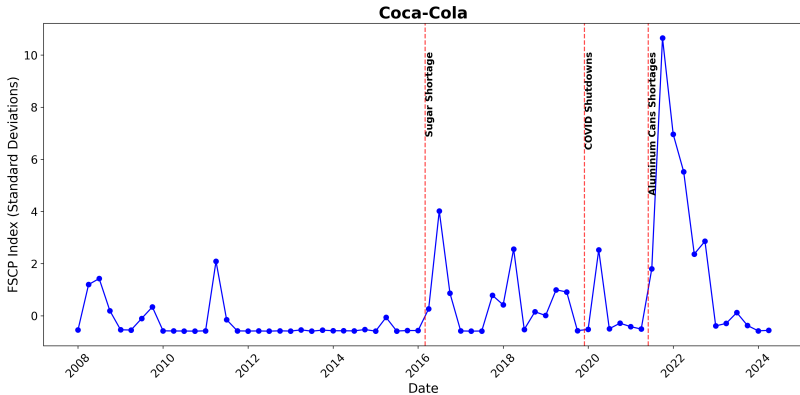
- 1 Reliable firm-level measure of supply chain pressure
- 2 How do these frictions affect monetary policy transmission?

Contribution

- 1 Construct a novel **supply chain pressure index at the firm-level** using **Natural Language Processing**

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Sugar Shortage

Covid Shutdown

Aluminum Shortage

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- ② Supply chain pressures impact monetary policy transmission
 - Firms **substitute** away from constrained inputs **toward capital**
 - **Larger price increases over the next six quarters**

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 - Firms **substitute** away from constrained inputs **toward capital**
 - **Larger price increases over the next six quarters**
- ③ **New Keynesian model with supply chain frictions**
 - **Effective inputs:** not all ordered inputs arrive on time or in usable condition.
 - **Capital** becomes relative more **productive**

Outline

- ① Measuring Firm-Level Supply Chain Pressure (FSCP)
- ② FSCP validation
 - Sentence level
 - Firm-level
- ③ Monetary policy under supply chain pressures
- ④ Conclusion

Measuring Firm-Level Supply Chain Pressure

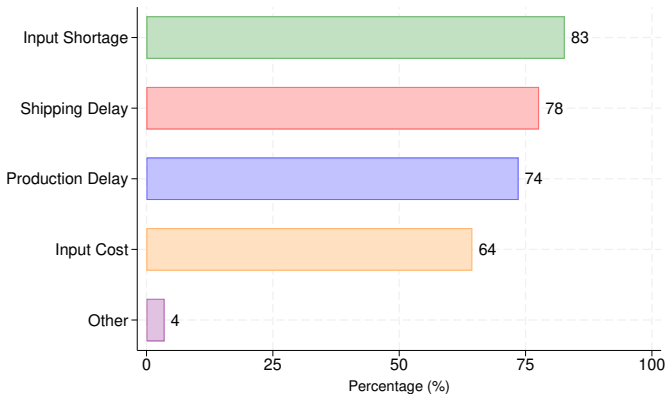
Raw data:

- 196,953 public-traded American companies' earnings conference call transcripts

NLP Methodology:

- ① Define supply chain pressures
- ② Two-step model:
 - Dictionary construction: preselect relevant sentences
 - Fine-tune language models to classify sentences related to supply chain pressures
 - BERT, RoBERTa, FinBERT, and Bag-of-Words
 - Robustness: *gpt-4o-mini* and *gpt-4o*

Supply Chain Pressures Can Arise From Various Dimensions



Source: Special module from the CFO Survey in 2021Q3. The CFO Survey is conducted by Duke University's Fuqua School of Business in partnership with the Federal Reserve Banks of Richmond and Atlanta.

Validation at the Sentence Level Examples

- In addition to the production issues we experienced, due to the above noted shortage of raw materials.
 - Balchem Corp - Jul 31, 2013 - Score: 0.996
- Because we've been in a world of trade wars, uncertainties, COVID and supply constraints now for a couple of years.
 - Jabil Inc. - Dec 16, 2021 - Score: 0.506
- Additionally, to further our productivity agenda, we are investing in our supply chain capabilities.
 - Central Garden Pet Company - Nov 22, 2021 - Score: 0.002

Validation at the Sentence Level Metrics

Validation at the Firm-Level

Perform **validation** tasks that most closely align with the specific **economic concept being measured** (Ganguli et al., 2024)

“Ground truth” events

- Natural disasters and significant logistical failures

Aggregation

Applications to Economic Events at the Firm-Level

- China's COVID-19 Shutdown in 2020 [Go](#)
- China Earthquake in 2008 [Go](#)
- Eyjafjallajökull Volcanic Eruption in 2010 [Go](#)
- Tohoku Earthquake in 2011 [Go](#)
- Philippines Typhoon Haiyan 2013 [Go](#)
- Brazil truck drivers strike in 2018 [Go](#)
- Trade War US and China (2018-2019) [Go](#)

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- ① Measuring Firm-Level Supply Chain Pressure (FSCP)
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 - Real activity: investment
 - Prices
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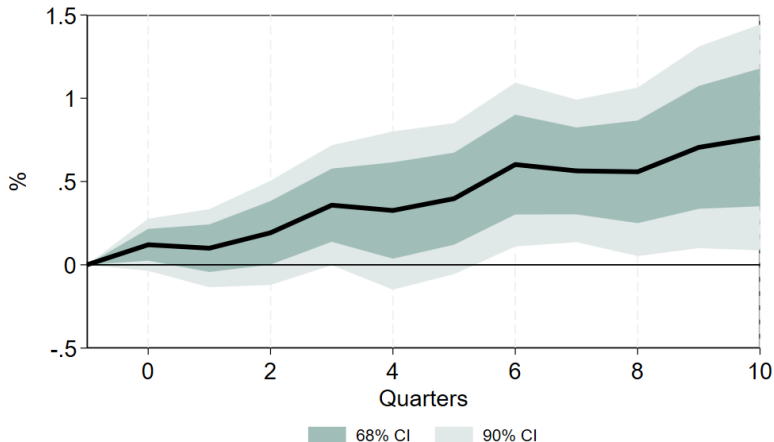
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 - ① Higher prices
 - ② Bypass pressures \implies Capital accumulation
 - ③ Prices + Capital

Empirical Strategy

$$y_{i,t+h} - y_{i,t-1} = \alpha^h + \beta^h \text{MPS}_t \times \mathbb{1}FSCP_{i,t-1} + \gamma^h Z_{i,t} + \alpha_i^h + \alpha_{s,t}^h + \epsilon_{i,t}^h.$$

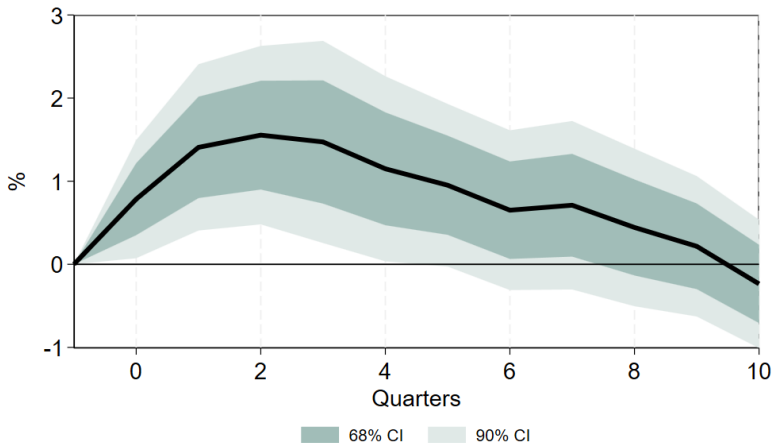
- **Outcome Variable** ($y_{i,t}$): log capital
- **Firm with Supply Chain Pressured** ($\mathbb{1}FSCP_{i,t-1}$): equals one if $FSCP_{i,t-1}$ is above zero, and zero otherwise.
- **Monetary Policy Shock** (MPS_t): Bauer and Swanson (2023)
- **Firm-specific controls** ($Z_{i,t}$): set of firm-level controls (interacted with lagged GDP growth as well)
- **Fixed-effects** (α_i): firm fixed-effects; ($\alpha_{s,t}$): industry \times time fixed-effects

Differential Investment Response Additional Exercises



β^h - **differential increase in capital** for firms under unusual supply chain pressures after MPS

Differential Price Adjustments Additional Exercises



β^h - **differential price adjustments response** for sectors under unusual supply chain pressures after MPS

Conclusion

- **Novel firm-level supply chain pressure index**
- Supply chain pressures impact the transmission of monetary policy
- Pressured firms **substitute scarce inputs with capital investment**
- High-pressure sectors show **sharper inflation overshoot**
- **Trade-off** between temporary inflation and long-run productivity gains

Suggestions are welcome!

Thank you!

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Additional Results and Robustness

- Are financial constraints driving the results? **No**
- Expansionary vs Contractionary Shock **Assymetry**
- Intangible Capital **Intangible**
- Cost of Goods Sold **COGS**
- Supply chain pressure persistency **Transition Matrix**
- Markup estimations **Markup**
- Alternative MPS **Capital** **Prices**
- Pre 2020 sample **Capital** **Prices**
- Alternative supply chain pressures **Capital** **Prices**