

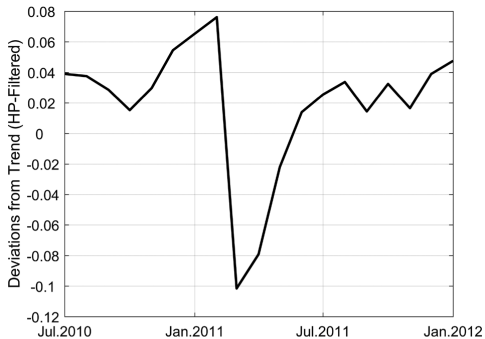
# International Trade and Macro: Supply-chain disruptions

## Example: Earthquake/tsunami in Japan

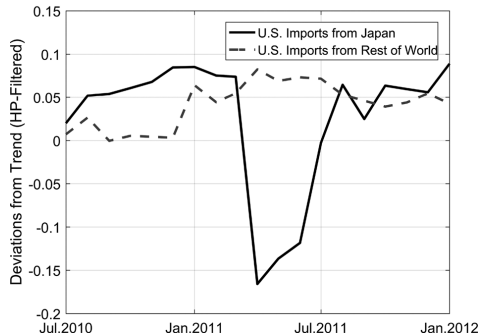
- ▶ Unexpected, immediate shutdown of manufacturing
- ▶ How hard is it to substitute around this shock? Boehm et al. ([2019](#))
- ▶ Focus on US affiliates of Japanese MNEs
- ▶ Hard to measure output at high frequency, use exports

# Tohoku earthquake

A. Index of Japanese Industrial Production: Manufacturing

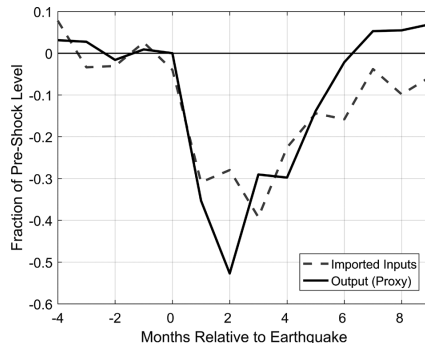
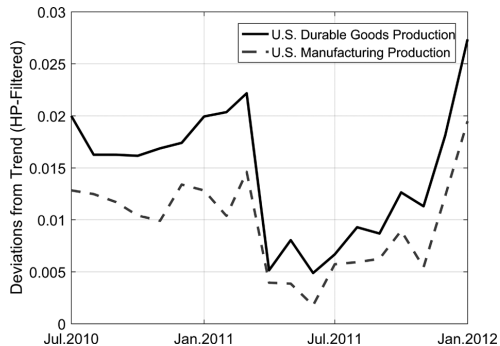


B. U.S. Imports from Japan and Rest of World



► Production in Japan and imports from Japan to US fall immediately

# Tohoku earthquake



- ▶ A measurable (though small) impact on aggregate production
- ▶ Big impact on US affiliates of Japanese MNEs (almost one-for-one)

## Example: Earthquake/tsunami in Japan

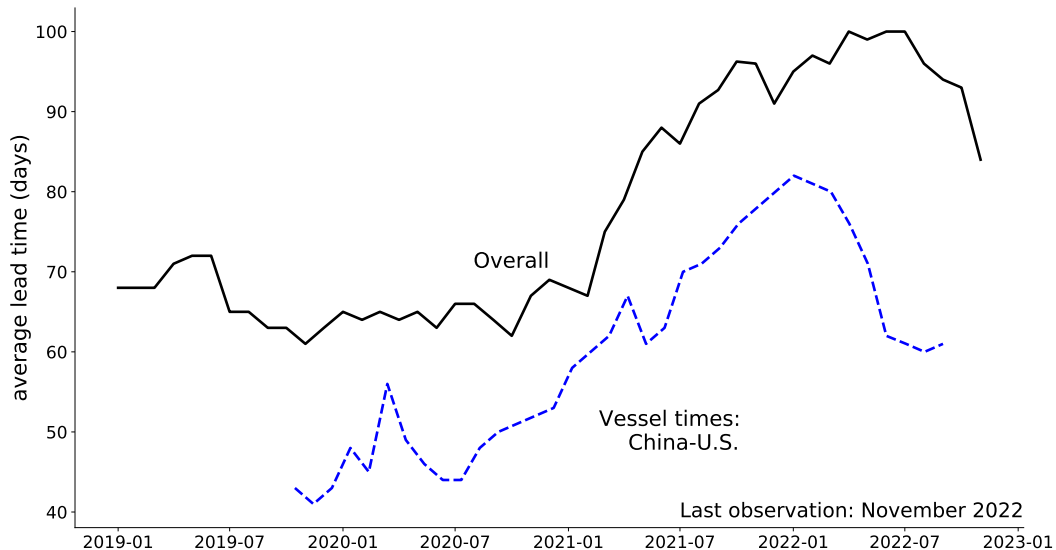
- ▶ Unexpected, immediate shutdown of manufacturing
- ▶ How hard is it to substitute around this shock? Boehm et al. (2019)
- ▶ Focus on US affiliates of Japanese MNEs
- ▶ Hard to measure output at high frequency, use exports
- ▶ Econometrics: short-run elasticity is about zero

## Example: COVID

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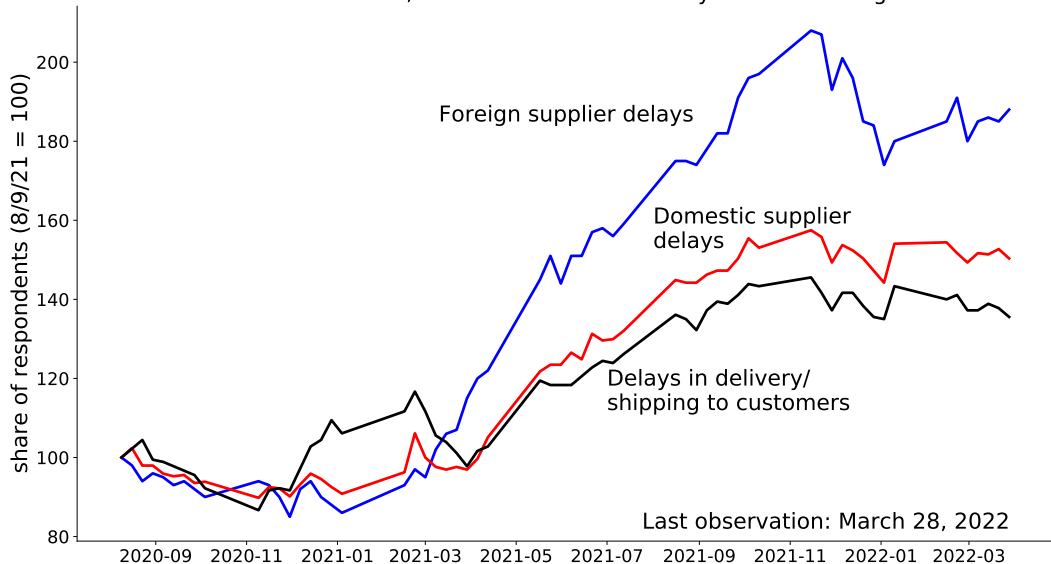
- ▶ Unexpected. Economies shut down on different schedules
- ▶ Disruptions became acute as economies reopened on different schedules
- ▶ Widespread across industries
- ▶ Domestic and international delays
- ▶ Long lasting (I still can't get new windows for my house)

## Delivery delays on production inputs



## Domestic and foreign supplier delays (Census, Pulse survey)

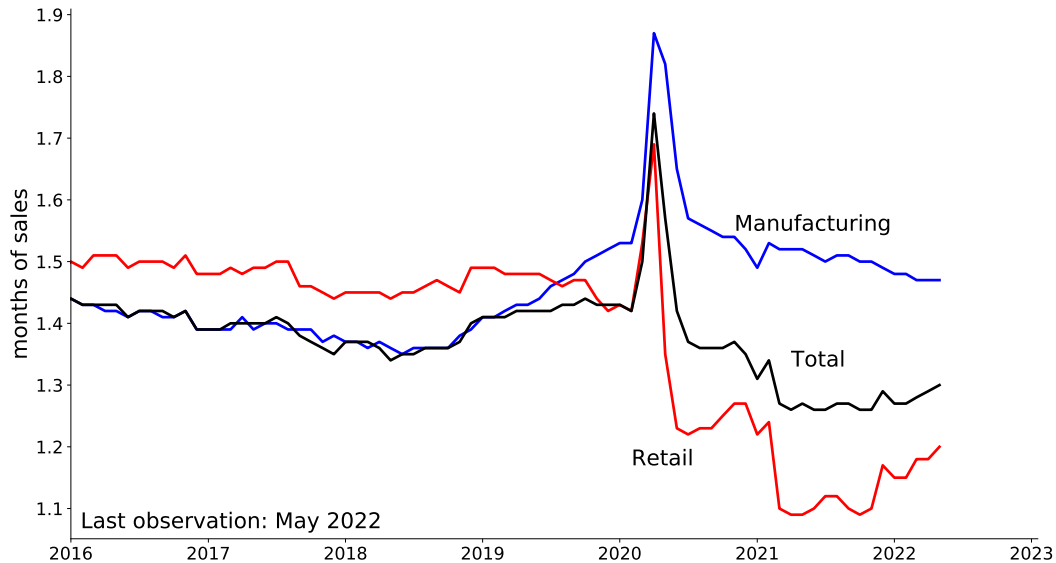
In the last week, did this business have any of the following?



Last observation: March 28, 2022



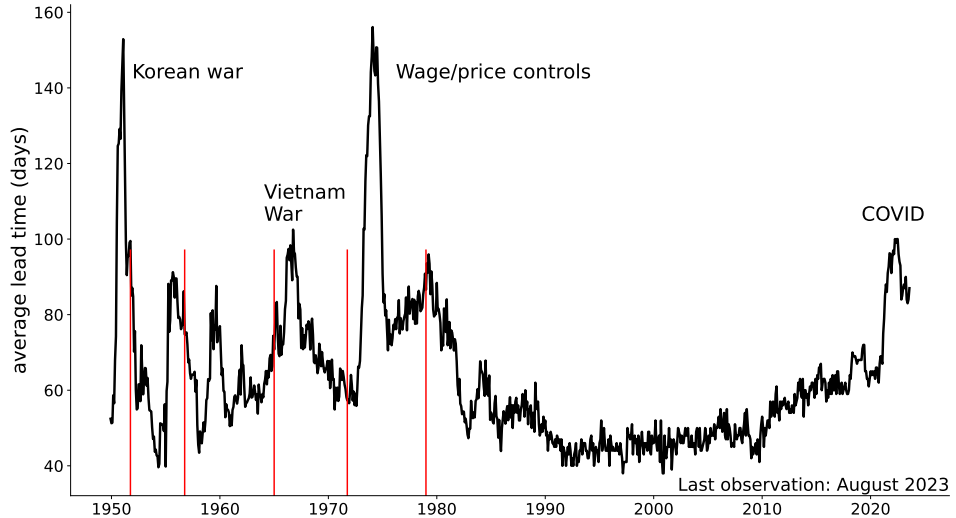
## Delays happening when inventory levels are low



## Example: COVID

- ▶ Unexpected. Economies shut down on different schedules
  - ▶ Disruptions became acute as economies reopened on different schedules
  - ▶ Widespread across industries
  - ▶ Domestic and international delays
  - ▶ Long lasting (I still can't get new windows for my house)
- 
- ▶ How common are supply disruptions? How costly are they in the aggregate?

# Lead time on production inputs



► Data from [Institute for Supply Management](#)

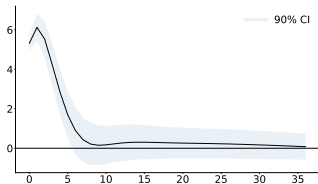
## Some VAR evidence

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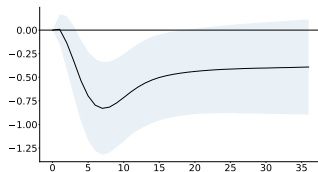
- ▶ Consider VAR with 3 blocks
- ▶ Real: IP, Sales, Inventory, Employment, ISM Delays
- ▶ Nominal: Wages, Price of Goods/Wage
- ▶ Int'l: Trade, Export-Import Ratio, Terms of trade, Price of Traded goods
- ▶ Real variables, then delays, then prices (robust to ordering)
- ▶ Consider impulse from delays and orthogonalized response of system

## Effects of a delay shock

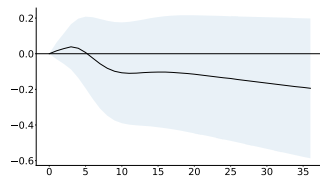
### Delivery days



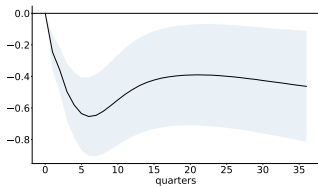
### Industrial production



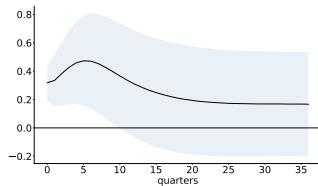
### Inventories



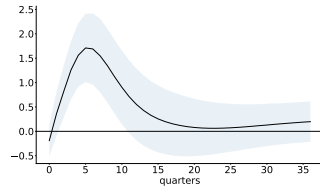
### Goods sales



### Goods prices



### Exports/imports



## Weathering supply disruptions

- ▶ Why didn't production of Japanese firms fall to zero? Inventory holdings.
- ▶ Did firms plan for the earthquake? Covid? The Panama Canal **running out of water**?
- ▶ Modeling questions:
  - ▶ Are the shocks contained to an industry, firm, or geography? Are they wide spread?
  - ▶ Were there warnings or did it happen unexpectedly?
  - ▶ How much did uncertainty increase around the event?
  - ▶ Are there congestion effects?
  - ▶ Can fast shipping modalities or other supply locations help?
  
- ▶ Let's put our inventory model in GE and allow for stochastic shipping times. . .

## References |

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Boehm, Christoph E., Aaron Flaen, and Nitya Pandalai-Nayar (Mar. 2019). "Input Linkages and the Transmission of Shocks: Firm-Level Evidence from the 2011 Tōhoku Earthquake." *The Review of Economics and Statistics* 101 (1), pp. 60–75.