Trade Disruptions and Reshoring

Anindya S. Chakrabarti (IIMA)
Kanika Mahajan (Ashoka University)
Shekhar Tomar (ISB)

ESEM/EEA Barcelona 2023

August 29, 2023

Background

- Firms are frequently exposed to delays in input sourcing and sales
  - Natural disasters, labor disputes and conflicts among others
  - 74 percent of the surveyed firms experience at least one disruption in their trade network (Alcantara & Riglietti, 2015)

Background

- Firms are frequently exposed to delays in input sourcing and sales
  - Natural disasters, labor disputes and conflicts among others
  - 74 percent of the surveyed firms experience at least one disruption in their trade network (Alcantara & Riglietti, 2015)
- Current work– output losses for firms having linkages to regions affected by such disruptions

Background

- Firms are frequently exposed to delays in input sourcing and sales
  - Natural disasters, labor disputes and conflicts among others
  - 74 percent of the surveyed firms experience at least one disruption in their trade network (Alcantara & Riglietti, 2015)
- Current work– output losses for firms having linkages to regions affected by such disruptions
  - Internationally (Boehm et al., 2019)
  - Within-country (Barrot & Sauvagnat, 2016; Carvalho et al., 2021)

Background

- Firms are frequently exposed to delays in input sourcing and sales
  - Natural disasters, labor disputes and conflicts among others
  - 74 percent of the surveyed firms experience at least one disruption in their trade network (Alcantara & Riglietti, 2015)
- Current work– output losses for firms having linkages to regions affected by such disruptions
  - Internationally (Boehm et al., 2019)
  - Within-country (Barrot & Sauvagnat, 2016; Carvalho et al., 2021)
- How firms withstand such shocks (do they reorient trade to mitigate losses?)

Question

- What happens to domestic trade after temporary trade disruption?

Question

- What happens to domestic trade after temporary trade disruption?
  - How do firms adjust?

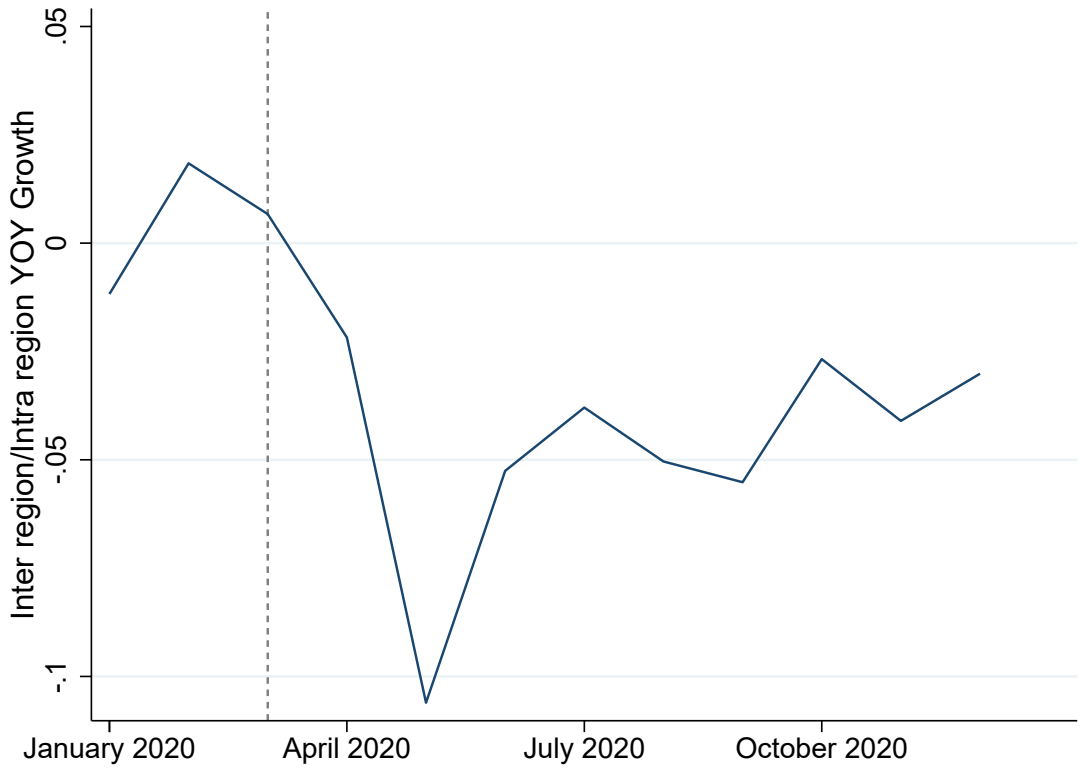
Question

- What happens to domestic trade after temporary trade disruption?
  - How do firms adjust?
- Setting: Domestic trade across 35 regions within a country (India)
  - Intra-country trade costs as high as inter-country trade costs (Atkin & Donaldson 2015)

Shock: COVID-19 National Lockdown India (March 2020)

Domestic Trade Collapse in India: Post COVID-19 Lockdown

Figure: Inter-State Sales to Intra-State Sales Ratio Growth (YoY)



What we do

- Document trade collapse within India post the pandemic induced lockdown: immediate and persistent

What we do

- Document trade collapse within India post the pandemic induced lockdown: immediate and persistent

- Reshoring Channel of Trade Collapse
  - Plants selling more outside pre-pandemic switch to intra-state sales
  - One s.d. increase in inter-state dependence $\rightarrow$ 8% (6%) higher (lower) intra-state (inter-state) sales
  - Similar results for inputs
  - Reshoring accounts for 7.6% growth in sales in Oct-Dec 2020

What we do

- Document trade collapse within India post the pandemic induced lockdown: immediate and persistent
- Reshoring Channel of Trade Collapse
  - Plants selling more outside pre-pandemic switch to intra-state sales
  - One s.d. increase in inter-state dependence $\rightarrow$ 8% (6%) higher (lower) intra-state (inter-state) sales
  - Similar results for inputs
  - Reshoring accounts for 7.6% growth in sales in Oct-Dec 2020
- Why reshoring?
  - Uncertainty about state border closure
  - Scope for home expansion (local demand + local production)

Data

- Electronic-way (E-way) Bills collected by the Goods and Services Tax Network (GSTN) in India
- Legal requirement to generate an E-way bill before transporting goods above INR 50,000 $\approx$ USD 700 (not services)
- Period: January 2019–December 2020
- Two unique administrative datasets at state level
  - Plant Data
  - Product Data

Plant Data

- Monthly Sales Data (B2B+B2C):
  - Two distinct datasets: inter-state and intra-state sales
  - Top 1000 plants at state$\times$month level
  - Unique plant identity: match over month or type of sales
  - Top 1000 plants constitute 60 percent to the total state level sales

Plant Data

- Monthly Sales Data (B2B+B2C):
  - Two distinct datasets: inter-state and intra-state sales
  - Top 1000 plants at state$\times$month level
  - Unique plant identity: match over month or type of sales
  - Top 1000 plants constitute 60 percent to the total state level sales
- Similar datasets on the input (B2B) side (inter- and intra-state inputs)
- Keep balanced set of plants for which we observe total sales for all 24 months

Plant Data: Summary Stats

- Monthly plant sales and inputs

Plant Data (Sales and Receipts, INR million)						
	2019			2020		
	Obs.	Mean	S.D.	Obs.	Mean	S.D.
(1) Number of plants (Sales data)	408	272.1	151.9	408	272.1	151.9
(2) Total Sales	111024	355.8	1342.6	111024	337.1	1410.3
(3) Inter-state Sales	81092	309	1238.5	81983	285.4	1368.5
(4) Intra-state Sales	80685	179.1	493.9	81041	173.1	460.1
(5) Number of plants (Inputs data)	408	265.6	85.1	408	265.6	85.1
(6) Total Inputs	108348	223.9	802.6	108348	212.2	982.4
(7) Inter-state Inputs	81883	200.8	597.3	83113	187.2	913.1
(8) Intra-state Inputs	65204	120.0	589.9	64715	115.0	547.0

Plant Data: Summary Stats

- Monthly plant sales and inputs

Plant Data (Sales and Receipts, INR million)						
	2019			2020		
	Obs.	Mean	S.D.	Obs.	Mean	S.D.
(1) Number of plants (Sales data)	408	272.1	151.9	408	272.1	151.9
(2) Total Sales	111024	355.8	1342.6	111024	337.1	1410.3
(3) Inter-state Sales	81092	309	1238.5	81983	285.4	1368.5
(4) Intra-state Sales	80685	179.1	493.9	81041	173.1	460.1
(5) Number of plants (Inputs data)	408	265.6	85.1	408	265.6	85.1
(6) Total Inputs	108348	223.9	802.6	108348	212.2	982.4
(7) Inter-state Inputs	81883	200.8	597.3	83113	187.2	913.1
(8) Intra-state Inputs	65204	120.0	589.9	64715	115.0	547.0

Plant Data: Summary Stats

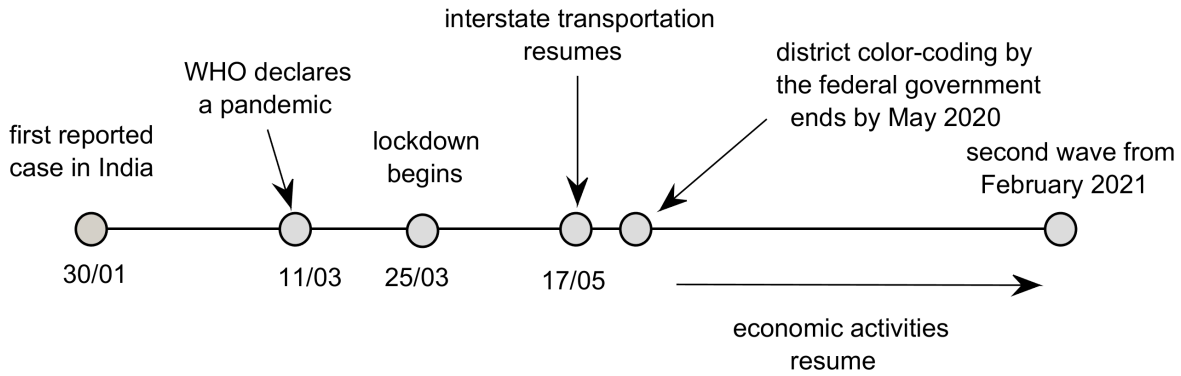
- Monthly plant sales and inputs

Plant Data (Sales and Receipts, INR million)						
	2019			2020		
	Obs.	Mean	S.D.	Obs.	Mean	S.D.
(1) Number of plants (Sales data)	408	272.1	151.9	408	272.1	151.9
(2) Total Sales	111024	355.8	1342.6	111024	337.1	1410.3
(3) Inter-state Sales	81092	309	1238.5	81983	285.4	1368.5
(4) Intra-state Sales	80685	179.1	493.9	81041	173.1	460.1
(5) Number of plants (Inputs data)	408	265.6	85.1	408	265.6	85.1
(6) Total Inputs	108348	223.9	802.6	108348	212.2	982.4
(7) Inter-state Inputs	81883	200.8	597.3	83113	187.2	913.1
(8) Intra-state Inputs	65204	120.0	589.9	64715	115.0	547.0

Product Data

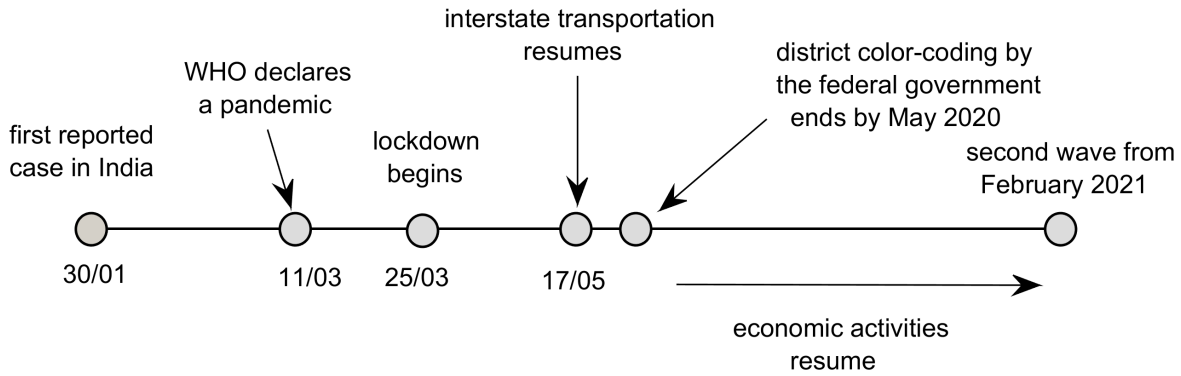
- January 2019–December 2020, product inter-state sales, intra-state sales and inter-state receivables (HSN 4-digit level)
- Monthly data for the top 1000 products in each of the three
- Summary statistics for a balanced set of products: total production (sales) data (*Intra-state Sales*+*Inter-state Sales*)

Timeline: COVID-19 and Policy response in 2020



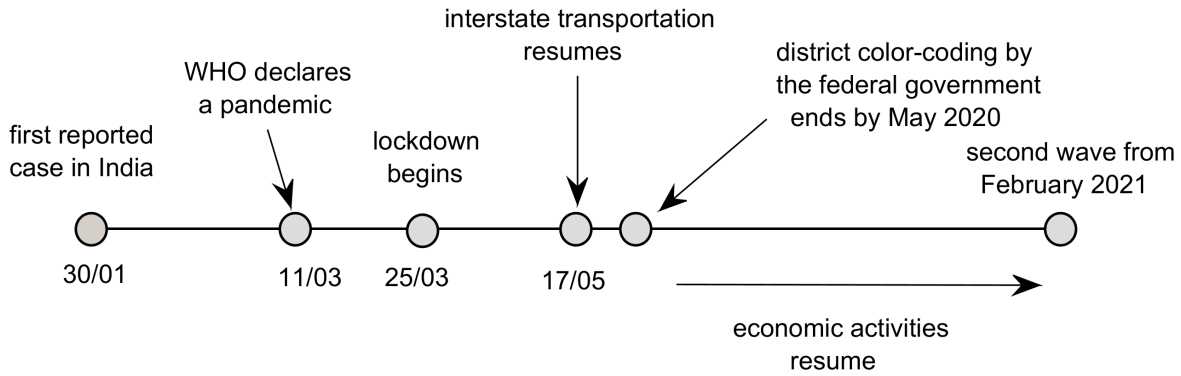
- March 25: Lockdown (movement of goods and people)

Timeline: COVID-19 and Policy response in 2020



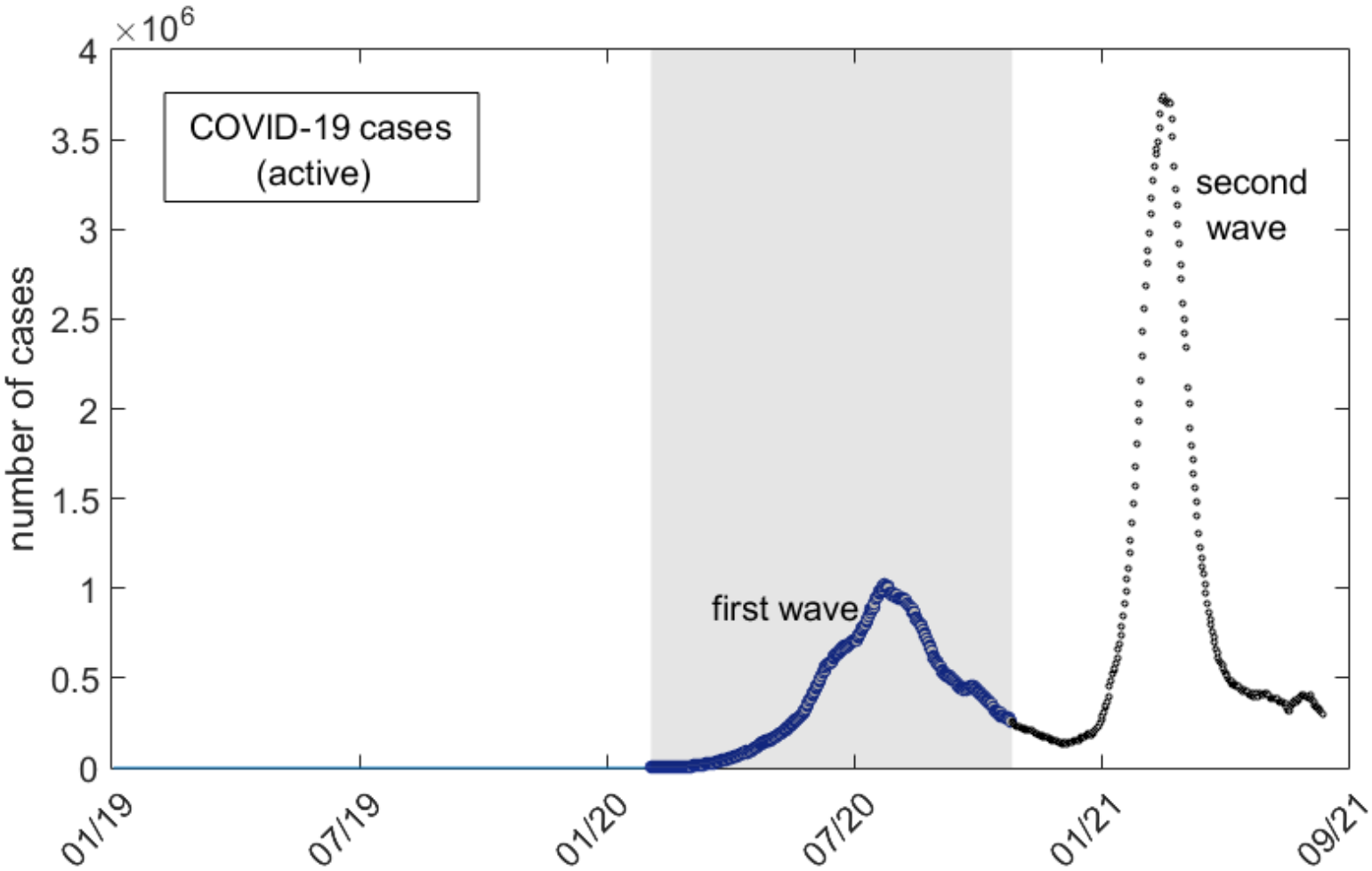
- March 25: Lockdown (movement of goods and people)
- May 17: inter-state transportation easing began

Timeline: COVID-19 and Policy response in 2020



- March 25: Lockdown (movement of goods and people)
- May 17: inter-state transportation easing began
- By July: All restrictions on transportation lifted
- By September, economic indices back to the pre-pandemic level

Timeline: Active COVID cases



Empirical Strategy: Inter-state dependence

- Using Gopinath and Neiman (2014) framework show that firms more exposed to inter-state trade are likely to shift sourcing from inter to intra state
- Measure Pre-pandemic Inter-state dependence (using 2019 data):

$$f_{ir}^{c} = \frac{c_{ir}^{inter}}{c_{ir}^{inter} + c_{ir}^{intra}}$$

f_{ir}^{c}: fraction of inter-state sales (input) over total sales (input) for a given category $c \in \{sales, input\}$ in 2019.

High $f_{ir}^{c} \rightarrow$ higher likelihood to shift to intra-state sales

Inter-State Dependence (2019)						
	Obs.	Mean	Median	S.D.	Min	Max
(1) Plants: Inter-state Sales Fraction	9252	0.53	0.59	0.40	0.00	1.00
(2) Plants: Inter-state Inputs Fraction	9029	0.64	0.84	0.40	0.00	1.00

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_1 (1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_2 (1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

- $z^c_{ijr,my}$: outcome variable for a plant i belonging to sector j in state r in month m and year y and category $c \in \{\text{Sales,Inputs}\}$.
- $z \in \{\text{Inter-state Sales, Intra-state sales, Inter-state inputs, Intra-state inputs}\}$

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_1 (1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_2 (1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

- $z^c_{ijr,my}$: outcome variable for a plant i belonging to sector j in state r in month m and year y and category $c \in$ {Sales,Inputs}.
- $z \in$ {Inter-state Sales, Intra-state sales, Inter-state inputs, Intra-state inputs}
- 1_m: dummy $= 1$ if the observation belongs to month m
- 1_{2020}: dummy $= 1$ one if year 2020

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_1 (1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_2 (1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

- $z^c_{ijr,my}$: outcome variable for a plant i belonging to sector j in state r in month m and year y and category $c \in$ {Sales,Inputs}.
- $z \in$ {Inter-state Sales, Intra-state sales, Inter-state inputs, Intra-state inputs}
- 1_m: dummy $= 1$ if the observation belongs to month m
- 1_{2020}: dummy $= 1$ one if year 2020
- $\delta^c_{ir,m}$: Plant level unobserved heterogeneity and plant month seasonality
- $\delta^c_{j,my}$: Sector$\times$month$\times$year fixed-effects (Demand and Price effects)

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_1 (1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma^{\tau,c}_2 (1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

- $z^c_{ijr,my}$: outcome variable for a plant i belonging to sector j in state r in month m and year y and category $c \in$ {Sales,Inputs}.
- $z \in$ {Inter-state Sales, Intra-state sales, Inter-state inputs, Intra-state inputs}
- 1_m: dummy $= 1$ if the observation belongs to month m
- 1_{2020}: dummy $= 1$ one if year 2020
- $\delta^c_{ir,m}$: Plant level unobserved heterogeneity and plant month seasonality
- $\delta^c_{j,my}$: Sector×month×year fixed-effects (Demand and Price effects)
- $X^c_{ir,my}$: Other controls ($\sum_{\tau \in (m2020)} \phi^{\tau,c}(1_m \times 1_{2020} \times X^c_{ir})$ and the relevant double interactions)

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma_1{}^{\tau,c}(1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma_2^{\tau,c}(1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma_1{}^{\tau,c}(1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma_2^{\tau,c}(1_m \times 1_{2020} \times f^c_{ir})$$
$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

- For c = Sales, z=Inter-state
- $\gamma_2^{\tau,sales}$: Impact of inter-state sales dependence on plant inter-state sales in month m in 2020 (Heterogeneous DID treatment effects)
- Change in plant inter-state sales in month m in year 2020 relative to January 2020, over and above the change in inter-state sales between month m in 2019 and January 2019, as a function of plants' inter-state sales dependence

Reshoring: Empirical strategy

$$ln(z^c_{ijr,my}) = \gamma^c_0 + \sum_{\tau \in (m2020)} \gamma_1{}^{\tau,c}(1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \gamma_2^{\tau,c}(1_m \times 1_{2020} \times f^c_{ir})$$

$$+ 1_{2020} \times f^c_{ir} + 1_{2020} + \delta^c_{ir,m} + \delta^c_{j,my} + X^c_{ir,my} + \varepsilon^c_{ijr,my}$$

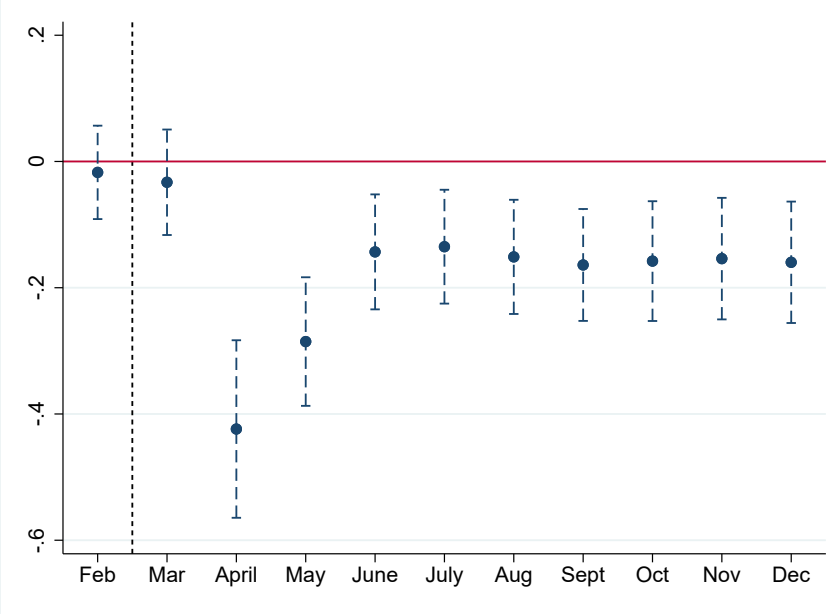
- For c = Sales, z=Inter-state
- $\gamma_2^{\tau,sales}$: Impact of inter-state sales dependence on plant inter-state sales in month m in 2020 (Heterogeneous DID treatment effects)
- Change in plant inter-state sales in month m in year 2020 relative to January 2020, over and above the change in inter-state sales between month m in 2019 and January 2019, as a function of plants' inter-state sales dependence

- For Reshoring: $\gamma_2^{\tau,sales}$ negative for inter and positive for intra-state sales

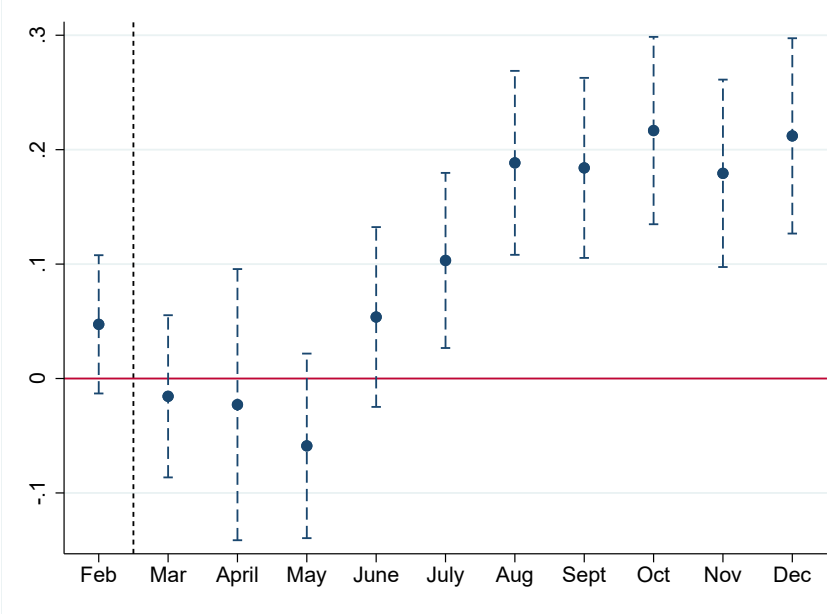
Results: Reshoring (Sales)

Impact on Inter- and Intra-state Sales

Dependent Variable: Inter-state Sales, Heterogeneity: By Sales Fraction



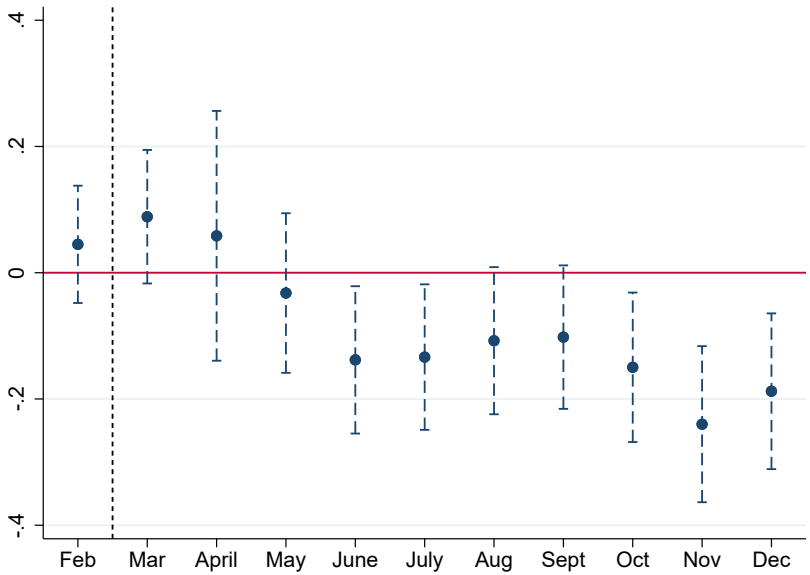
Dependent Variable: Intra-state Sales, Heterogeneity: By Sales Fraction



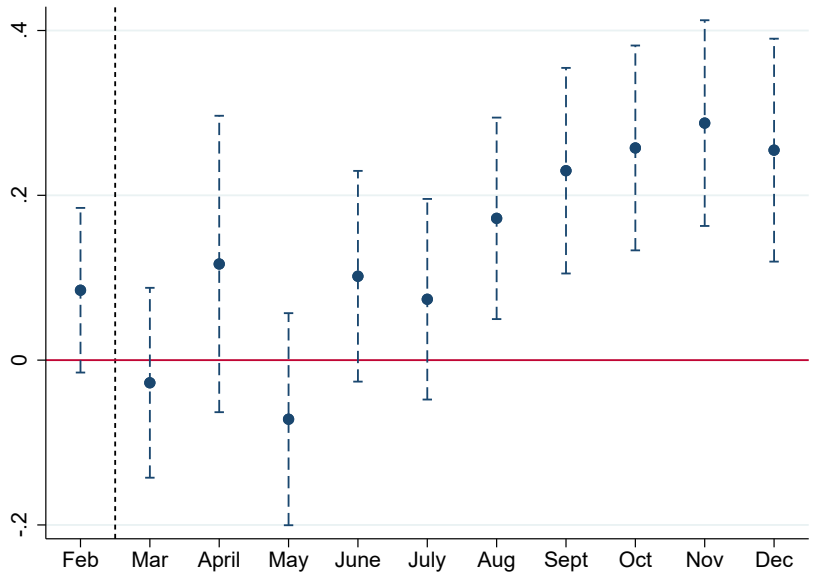
Results: Reshoring (Inputs)

Impact on Inter- and Intra-state Inputs

Dependent Variable: Inter-state Inputs, Heterogeneity: By Inputs Fraction

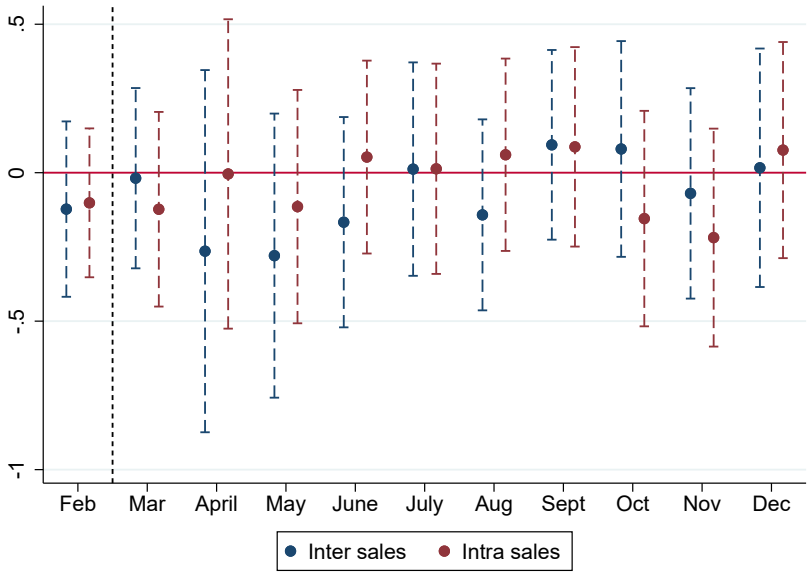


Dependent Variable: Intra-state Inputs, Heterogeneity: By Inputs Fraction

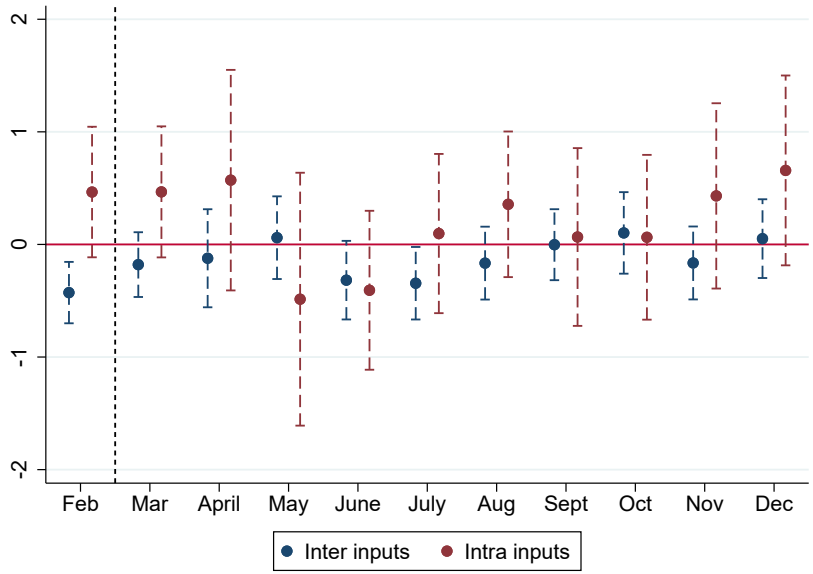


Results: Plants' Financial Condition do not Matter

Dependent Variable: Sales,
Heterogeneity: By Cash to Assets Ratio



Dependent Variable: Sales,
Heterogeneity: By Cash to Assets Ratio



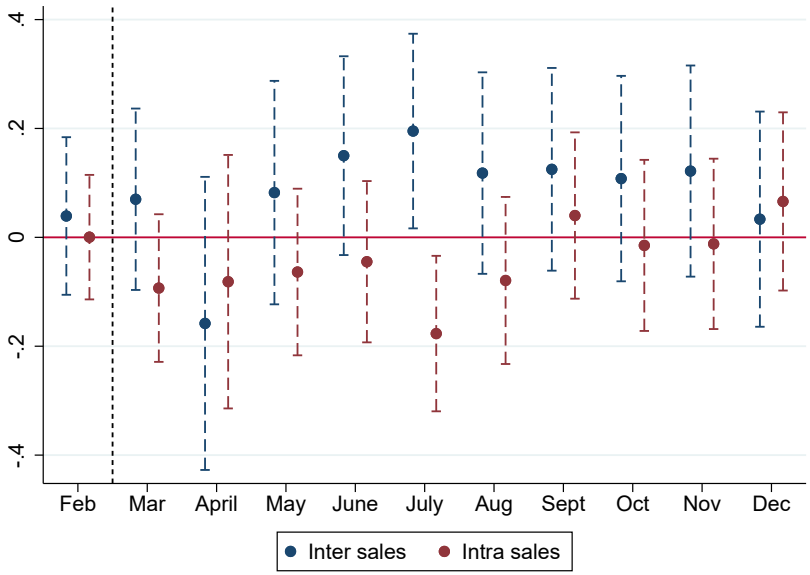
Other tests

- Plants that suffer more in total output post-lockdown reshore their sales or inputs home-ward Click
- Decline in Quantity: Count of E-way Bills as proxy
- Similar reshoring in product-level data
- Robustness
  - Longer pre-trends when not controlling for plant-monthly seasonality
  - Alternate Plant Sample – unbalanced sample
  - District level Variation in lockdown Stringency
  - Remove plants that engage in international trade

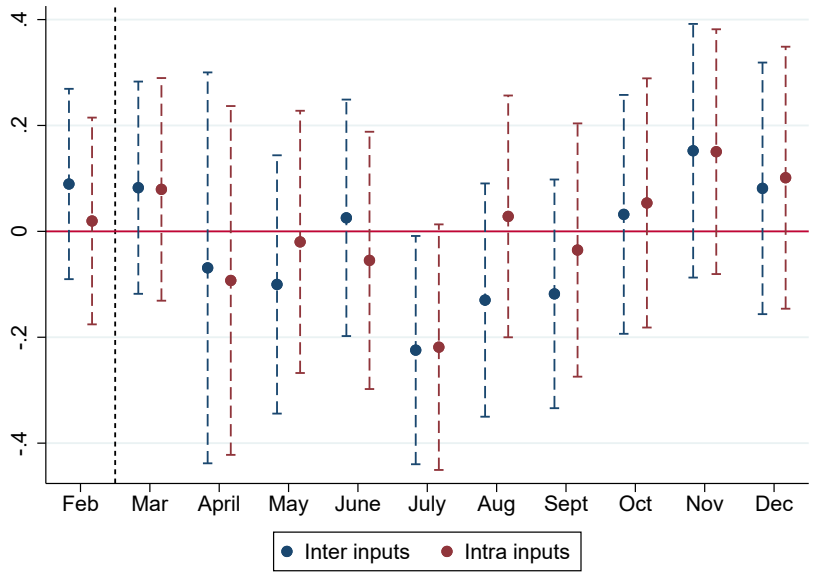
What explains reshoring? Salience of State Administrative Border

Reshoring is similar for border and inland plants

Sales: By Inter-state Sales Fraction × Border



Inputs: By Inter-state Inputs Fraction × Border



Product data: Scope for Home Expansion (SHE)

- Which products undergo the most reshoring?

Product data: Scope for Home Expansion (SHE)

- Which products undergo the most reshoring?
- Scope for expanding in the home state for product k in state r given by:

$$SHE_{kr} = \min \left[\frac{\text{Receipts}_{kr}^{inter}}{\text{Receipts}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \ , \ \frac{\text{Sales}_{kr}^{inter}}{\text{Sales}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \right]$$

Product data: Scope for Home Expansion (SHE)

- Which products undergo the most reshoring?
- Scope for expanding in the home state for product k in state r given by:

$$SHE_{kr} = \min \left[\frac{\text{Receipts}_{kr}^{inter}}{\text{Receipts}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \ , \ \frac{\text{Sales}_{kr}^{inter}}{\text{Sales}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \right]$$

- If state r does not sell any k outside its home state before the pandemic, then $SHE_{kr} = 0$

Product data: Scope for Home Expansion (SHE)

- Which products undergo the most reshoring?
- Scope for expanding in the home state for product k in state r given by:

$$SHE_{kr} = \min \left[\frac{\text{Receipts}_{kr}^{inter}}{\text{Receipts}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \ , \ \frac{\text{Sales}_{kr}^{inter}}{\text{Sales}_{kr}^{inter} + \text{Sales}_{kr}^{intra}} \right]$$

- If state r does not sell any k outside its home state before the pandemic, then $SHE_{kr} = 0$
- If state r does not buy k from other states before the pandemic, then $SHE_{kr} = 0$

Product data: Scope for Home Expansion (SHE)

- Which products undergo the most reshoring?
- Scope for expanding in the home state for product k in state r given by:

$$SHE_{kr} = \min\left[\frac{\text{Receipts}_{kr}^{inter}}{\text{Receipts}_{kr}^{inter} + \text{Sales}_{kr}^{intra}}, \frac{\text{Sales}_{kr}^{inter}}{\text{Sales}_{kr}^{inter} + \text{Sales}_{kr}^{intra}}\right]$$

- If state r does not sell any k outside its home state before the pandemic, then $SHE_{kr} = 0$
- If state r does not buy k from other states before the pandemic, then $SHE_{kr} = 0$
- When both these fractions are large, outside state receipts for product k in state r can be substituted by home production ⏩ Grubel-Loyd Index?

Empirical Strategy: Reshoring by SHE

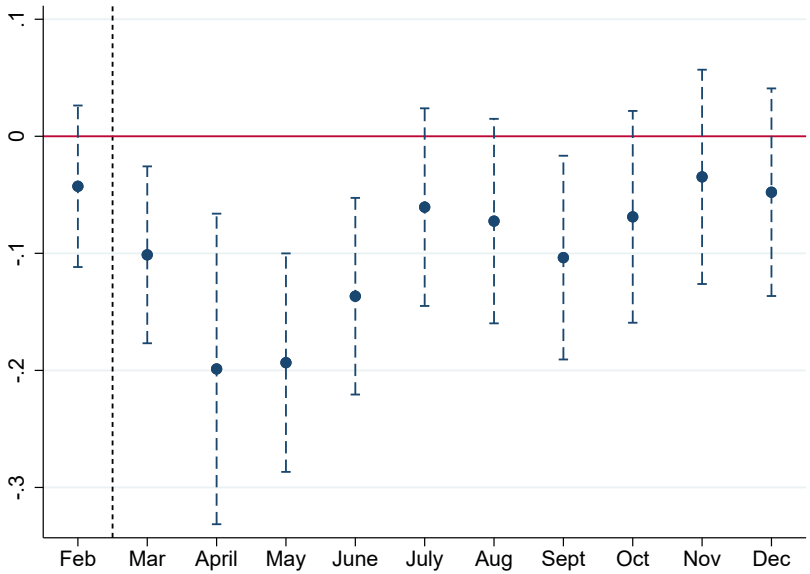
$$ln(z_{kr,my}) = \pi_0 + \sum_{\tau \in (m2020)} \pi_1^{\tau}(1_m \times 1_{2020}) + \sum_{\tau \in (m2020)} \pi_2^{\tau}(1_m \times 1_{2020} \times SHE_{kr})$$
$$+ 1_{2020} \times SHE_{kr} + 1_{2020} + \delta_{kr,m} + \delta_{k,my} + X_{kr,my} + \varepsilon_{kr,my}$$

- $z_{kr,my}$: outcome variable (Inter-state Sales, Intra-state sales) for product k produced in state r, in month m and year y
- $\delta_{kr,m}$: Product-state level unobserved heterogeneity and seasonality
- $\delta_{k,my}$: Variation over time in product demand at 4-digit HSN code level
- $X_{kr,my}$: Other controls (Inter-state Receivables Fraction)
- π_2^{τ}: Impact of SHE on product outcomes in month m in 2020

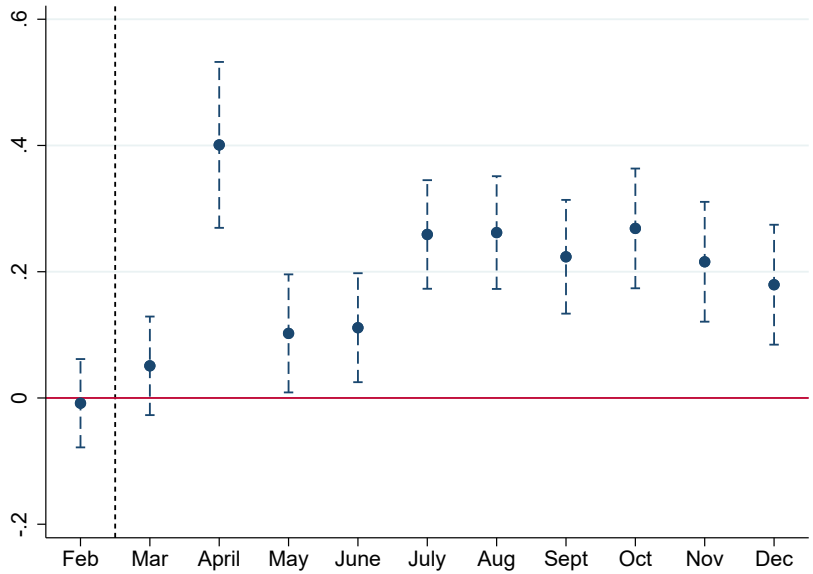
Results: High SHE → More Reshoring

Impact on Inter- and Intra-state Sales

Dependent Variable: Inter-state Sales, Heterogeneity: By SHE_{kr}



Dependent Variable: Intra-state Sales, Heterogeneity: By SHE_{kr}



Summary: *SHE* Results

- Scope for Home Expansion matters:
  - Larger reduction in inter-state product sales immediately after the lockdown by 5% for one S.D. increase in SHE_{kr}
  - Larger increase in intra-state product sales by 10% after the lockdown which persist at 6.5% (July-December 2020) for one S.D. increase in SHE_{kr}
- Total sales recover for products with high SHE ⏩ Click
- Product Differentiation: Other product attributes don't matter (Rausch classification)

Conclusion

- Causal evidence for reshoring after a temporary trade disruption
  - New channel to explain trade collapse
  - Evidence for a home-ward shift at plant and product level
    - Final and intermediate goods
    - Higher for plants that were more dependent on outside state sales and inputs before the pandemic
- Reshoring is:
  - Salient along state administrative borders
  - Dominant for products with high SHE
- Reshoring can aid recovery after shocks (7.6% of the sales growth in Oct-Dec 2020)
  - states exporting "less specific" products rebound faster

APPENDIX

Theoretical Setup

- Consider a home-region firm i, manufactures a unique good i using production technology:

$$Y_i = A_i L_{p,i}^{1-\mu} X_i^{\mu} \tag{1}$$

where A_i is the productivity of firm i, $L_{p,i}$ is the labor used for production and X_i is the intermediate input.

Theoretical Setup

- Consider a home-region firm i, manufactures a unique good i using production technology:

$$Y_i = A_i L_{p,i}^{1-\mu} X_i^{\mu} \tag{1}$$

where A_i is the productivity of firm i, $L_{p,i}$ is the labor used for production and X_i is the intermediate input.

- X_i combines intra-region inputs Z_i and inter-region inputs M_i:

$$X_i = \left[Z_i^{\rho} + M_i^{\rho} \right]^{\frac{1}{\rho}}. \tag{2}$$

Theoretical Setup

- Consider a home-region firm i, manufactures a unique good i using production technology:

$$Y_i = A_i L_{p,i}^{1-\mu} X_i^{\mu} \tag{1}$$

where A_i is the productivity of firm i, $L_{p,i}$ is the labor used for production and X_i is the intermediate input.

- X_i combines intra-region inputs Z_i and inter-region inputs M_i:

$$X_i = \left[Z_i^{\rho} + M_i^{\rho}\right]^{\frac{1}{\rho}}. \tag{2}$$

$$Z_i = \left[\int_j z_{ij}^{\theta} dj\right]^{\frac{1}{\theta}} \quad , \quad M_i = \left[\int_{k \in \Omega_i} m_{ik}^{\theta} dk\right]^{\frac{1}{\theta}}. \tag{3}$$

- Z_i and M_i aggregate intra-region and inter-region varieties; elasticity of substitution same over the bundles
- z_{ij} is the set of intra-region inputs j; m_{ik} the set of inter-region inputs k.

Theoretical Setup

- Firm i only imports a set Ω_i of the available inter-region varieties.
- fixed costs increasing in number of inter-region varieties imported:

$$F(|\Omega_i|) = f|\Omega_i|^{\lambda} \tag{4}$$

where $f > 0, \lambda > 0$;

Theoretical Setup

- Output from each firm i: final good production and intermediate input

$$Y_i = g_i + z_i = g_i + \int_j z_{ji} dj. \tag{5}$$

- Final good $G = \left[\int_j g_i^{\theta} di\right]^{\frac{1}{\theta}}$

Theoretical Setup

- All firms monopolistically competitive and take the wages w, set of intra-region prices p_j, and inter-region input prices p_m

Theoretical Setup

- All firms monopolistically competitive and take the wages w, set of intra-region prices p_j, and inter-region input prices p_m
- Unit cost function of the firm:

$$C_i = \frac{1}{\mu^{\mu}(1-\mu)^{(1-\mu)}} \frac{w^{1-\mu} P_{X_i}^{\mu}}{A_i}. \tag{6}$$

where P_{X_i} is the price index of the intermediates for firm i:

Theoretical Setup

- All firms monopolistically competitive and take the wages w, set of intra-region prices p_j, and inter-region input prices p_m
- Unit cost function of the firm:

$$C_i = \frac{1}{\mu^{\mu}(1-\mu)^{(1-\mu)}} \frac{w^{1-\mu} P_{X_i}^{\mu}}{A_i}. \tag{6}$$

where P_{X_i} is the price index of the intermediates for firm i:

$$P_{X_i} = \left[P_Z^{\frac{\rho}{\rho-1}} + P_{M_i}^{\frac{\rho}{\rho-1}} \right]^{\frac{\rho-1}{\rho}}. \tag{7}$$

Theoretical Setup

- Home-region and inter-region input price indices:

$$P_Z = \left[\int_j p_i^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}}, \quad P_{M_i} = \left[\int_k p_m^{\frac{\theta}{\theta-1}} dk\right]^{\frac{\theta-1}{\theta}} = p_m |\Omega_i|^{\frac{\theta-1}{\theta}}. \tag{8}$$

P_Z same across all firms; P_{Mi} varies depending on the number of inter-region varieties $|\Omega_i|$ used by i

Theoretical Setup

- Home-region and inter-region input price indices:

$$P_Z = \left[\int_j p_i^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}} \quad , \quad P_{M_i} = \left[\int_k p_m^{\frac{\theta}{\theta-1}} dk\right]^{\frac{\theta-1}{\theta}} = p_m |\Omega_i|^{\frac{\theta-1}{\theta}}. \tag{8}$$

  P_Z same across all firms; P_{Mi} varies depending on the number of inter-region varieties $|\Omega_i|$ used by i

- Price charged: C_i/θ and chooses the optimal Ω_i to maximize its profits.

Theoretical Setup

- Home-region and inter-region input price indices:

$$P_Z = \left[\int_j p_i^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}}, \quad P_{M_i} = \left[\int_k p_m^{\frac{\theta}{\theta-1}} dk\right]^{\frac{\theta-1}{\theta}} = p_m |\Omega_i|^{\frac{\theta-1}{\theta}}. \tag{8}$$

  P_Z same across all firms; P_{Mi} varies depending on the number of inter-region varieties $|\Omega_i|$ used by i

- Price charged: C_i/θ and chooses the optimal Ω_i to maximize its profits.

- Inter region prices (p_m): same for all varieties, includes iceberg trade cost and price increase to accommodate uncertainty in arrival of good
  - Uncertainty goes up, p_m goes up

Propositions

- Proposition 1 (Trade collapse): *Under certain parametric restrictions, an increase in uncertainty captured by an increase in inter-region input price p_m, increases the share of domestic inputs in total inputs for firm i (γ_i).*

$$\frac{\partial\ ln\gamma_i}{\partial\ lnp_m} = \frac{\rho(1-\gamma_i)}{1-\rho}\left[1 - \frac{\partial\ lnP_Z}{\partial\ lnp_m} + \frac{\theta-1}{\theta}\frac{\partial\ ln\Omega_i}{\partial\ lnp_m}\right] > 0. \tag{9}$$

Propositions

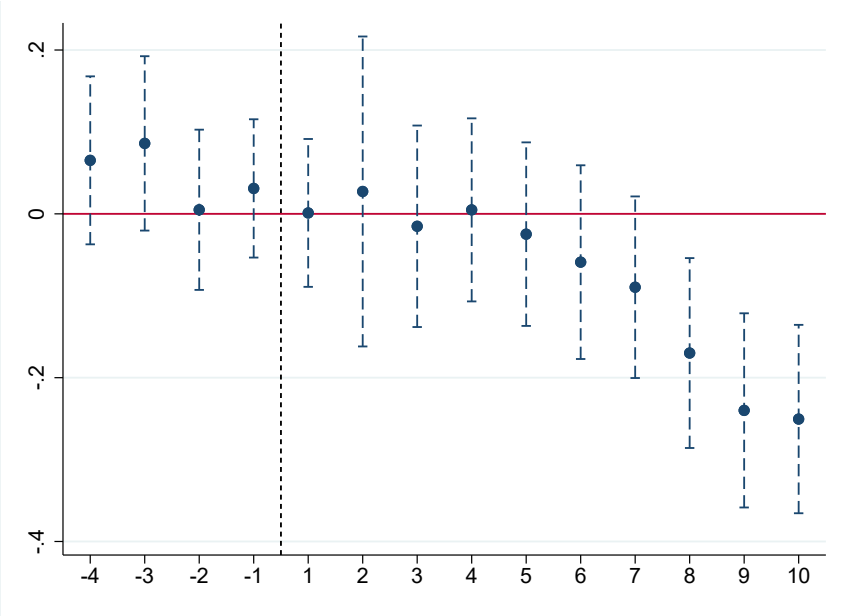
- Proposition 1 (Trade collapse): *Under certain parametric restrictions, an increase in uncertainty captured by an increase in inter-region input price p_m, increases the share of domestic inputs in total inputs for firm i (γ_i).*

$$\frac{\partial\ ln\gamma_i}{\partial\ lnp_m} = \frac{\rho(1-\gamma_i)}{1-\rho}\left[1 - \frac{\partial\ lnP_Z}{\partial\ lnp_m} + \frac{\theta-1}{\theta}\frac{\partial\ ln\Omega_i}{\partial\ lnp_m}\right] > 0. \tag{9}$$

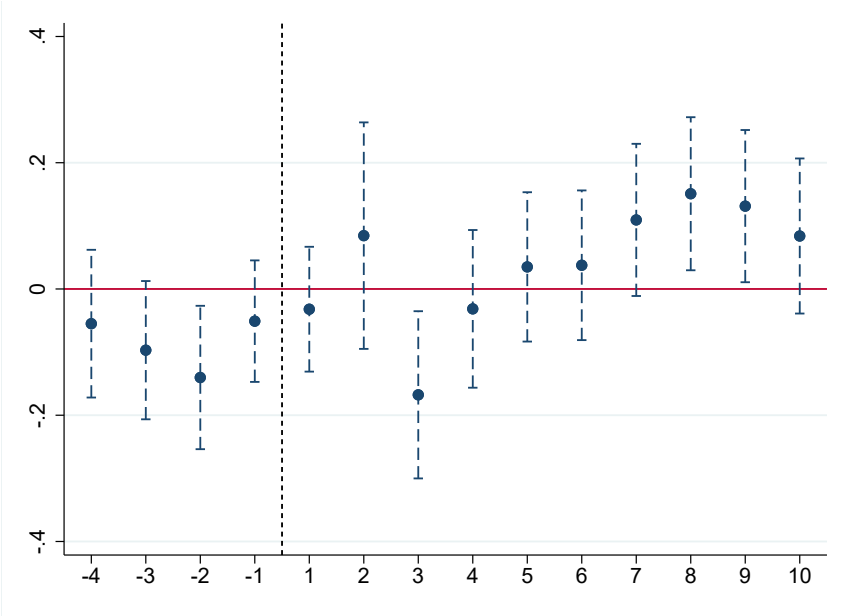
- Proposition 2: *When trade collapse occurs, and $\partial(\frac{\partial\ ln\Omega_i}{\partial\ lnp_m})/\partial\gamma_i > 0$, the shift to intra-region inputs is larger for firms with a higher dependence on inter-region intermediate inputs after an increase in uncertainty* $(\frac{\partial(\frac{\partial\ ln\gamma_i}{\partial\ lnp_m})}{\partial\ \gamma_i} < 0)$

Back

Appendix: Plant Inputs, Single difference pre-trends



Inter-Region Inputs: By Inputs Fraction



Intra-Region Inputs: By Inputs Fraction

Results for Total Plant Sales and Inputs: By inter-regional dependence

Dependent variable:	log(Total Sales)			log(Total Inputs)		
	(1)	(2)	(3)	(4)	(5)	(6)
Reg. Dependence=	Inter-Region Sales Fraction ×			Inter-Region Inputs Fraction ×		
Feb 2020	0.01	0.00	−0.00	−0.01	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Mar 2020	−0.03**	−0.04**	−0.05**	−0.05***	−0.06***	−0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Apr 2020	−0.20***	−0.34***	−0.38***	−0.27***	−0.34***	−0.17***
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)
May 2020	−0.13***	−0.16***	−0.17***	−0.14***	−0.19***	−0.18***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
June 2020	−0.05***	−0.05**	−0.06***	−0.07***	−0.12***	−0.11***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
July 2020	0.01	0.01	−0.00	−0.06***	−0.10***	−0.06**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Aug 2020	−0.04**	−0.04**	−0.05**	−0.04**	−0.07***	−0.04
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Sep 2020	−0.02	−0.04*	−0.05**	−0.01	−0.02	−0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Oct 2020	0.03*	0.02	0.01	−0.01	−0.02	−0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Nov 2020	−0.07***	−0.05**	−0.06**	−0.06***	−0.06***	−0.06**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Dec 2020	−0.04**	−0.03	−0.03	0.01	−0.01	−0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Fixed Effects						
Plant-Month	✓	✓	✓	✓	✓	✓
Sector-Month-Year		✓	✓		✓	✓
Additional Controls			✓			✓
N	222048	177408	164736	216696	148368	122712

Back

Robustness (Plants)

- Alternate Plant Sample – unbalanced sample
- Regional Variation in Stringency – local lockdowns
- Export-import status

Back

Why not Grubel-Loyd Index?

- For the i-th product, it is given by $GL_i = 1 - \frac{|X_i - M_i|}{X_i + M_i}$ where X and M represents export and import

Why not Grubel-Loyd Index?

- For the i-th product, it is given by $GL_i = 1 - \frac{|X_i - M_i|}{X_i + M_i}$ where X and M represents export and import
- Objective is to estimate the impact on intra-region sales, and not just the change in inter-region trade.
- The index does not respond to total production capturing inter- and intra-region sales whereas the proposed measure SHE_{kr} does.

Why not Grubel-Loyd Index?

- For the i-th product, it is given by $GL_i = 1 - \frac{|X_i - M_i|}{X_i + M_i}$ where X and M represents export and import
- Objective is to estimate the impact on intra-region sales, and not just the change in inter-region trade.
- The index does not respond to total production capturing inter- and intra-region sales whereas the proposed measure SHE_{kr} does.
- Eg 1: export-import pair with values $\{5,\ 5\}$ and two cases with total production value being 10 or 100

Why not Grubel-Loyd Index?

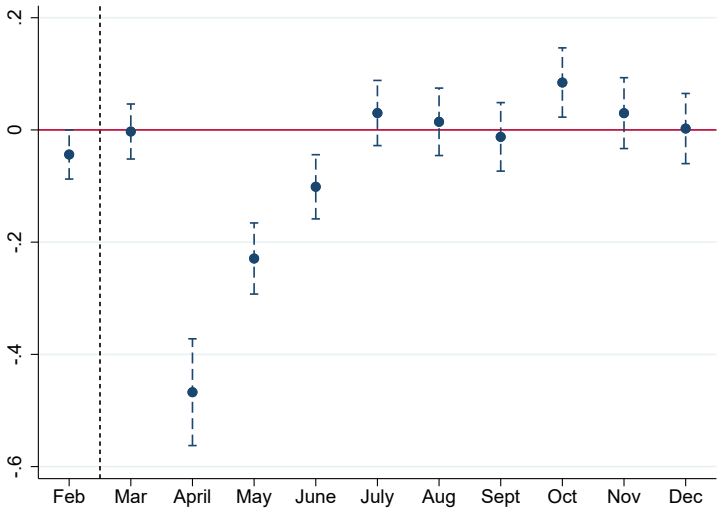
- For the i-th product, it is given by $GL_i = 1 - \frac{|X_i - M_i|}{X_i + M_i}$ where X and M represents export and import
- Objective is to estimate the impact on intra-region sales, and not just the change in inter-region trade.
- The index does not respond to total production capturing inter- and intra-region sales whereas the proposed measure SHE_{kr} does.
- Eg 1: export-import pair with values $\{5,\ 5\}$ and two cases with total production value being 10 or 100
- Eg 2: export-import pairs with values $\{5,\ 5\}$ and $\{100,\ 100\}$; with same intra-region sales value, say 10

Back

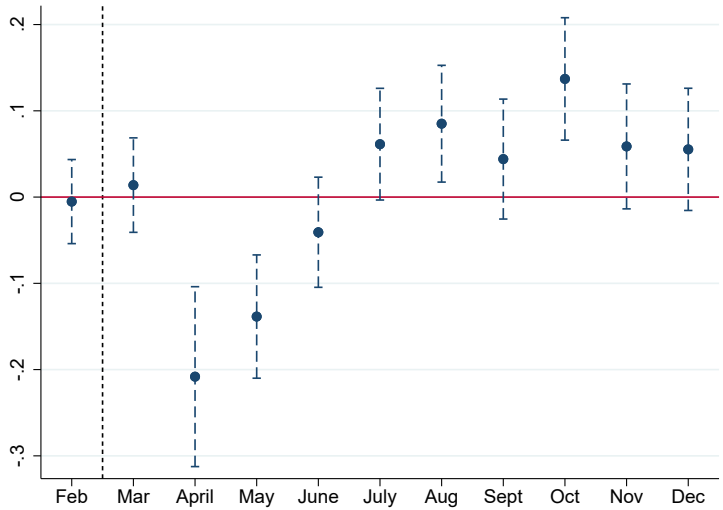
Results: Total Product Sales (By f_{kr} and SHE_{kr})

Figure: Impact on Total Product Sales

By Inter-Region Sales Fraction



By Scope for Home Expansion



Back