Disentangling the Effects of the 2018-2019 Tariffs on a Globally Connected U.S. Manufacturing Sector

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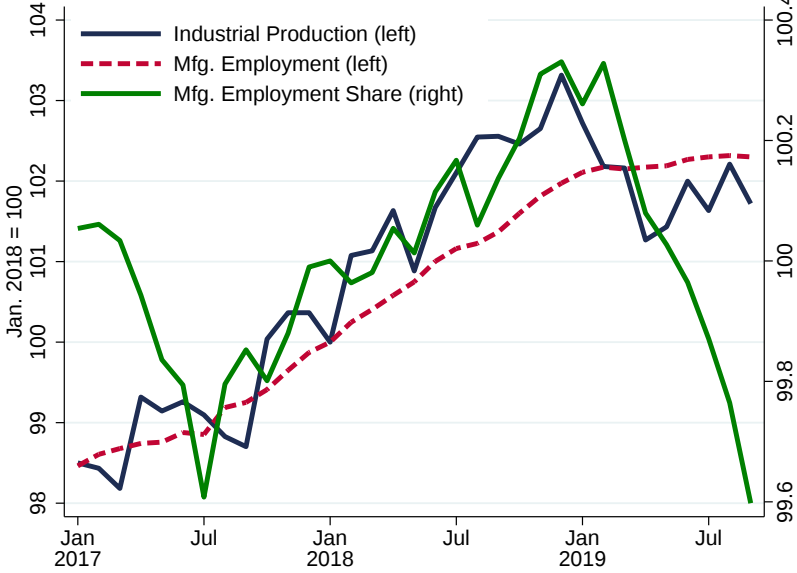
Disclaimer: Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the Board of Governors or its research staff.

Motivation

- Beginning in 2018-2019, and continuing in 2025, an increase in tariffs with no precedent in a world of global supply chains.
- In both periods, multiple goals cited, but one key aim was/is an effort to revive U.S. manufacturing
- With complex and global connections of U.S. manufacturing, tariff impacts operate through multiple channels:
  - Import protection may make some domestic industries more competitive relative to imports, boosting output, employment
  - Rising input costs and foreign retaliation may lower competitiveness, causing some industries to contract

Manufacturing Activity 2017-2019



Overview and Main Findings

Looking back (This paper): Evidence on the short-run effects of the 2018-2019 tariffs on the U.S. manufacturing sector.

What we do:

- Construct industry-level measures of 3 channels through which tariffs could affect manufacturing...
  - Import protection; rising input costs, export retaliation
- ...and assess their impact on aspects of manufacturing activity
  - Employment, output, producer prices, unemployment rates

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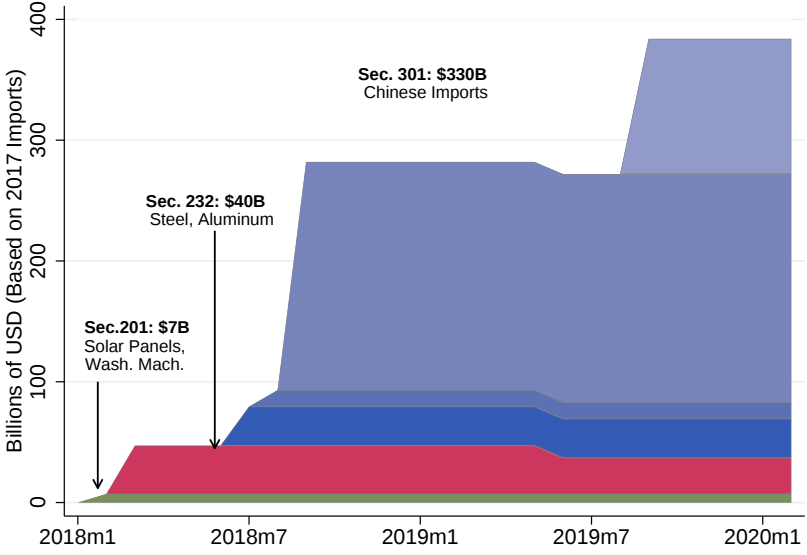
Looking Ahead: Preview industry exposure to tariffs on Canada and Mexico.

Background: Timeline of New Tariffs



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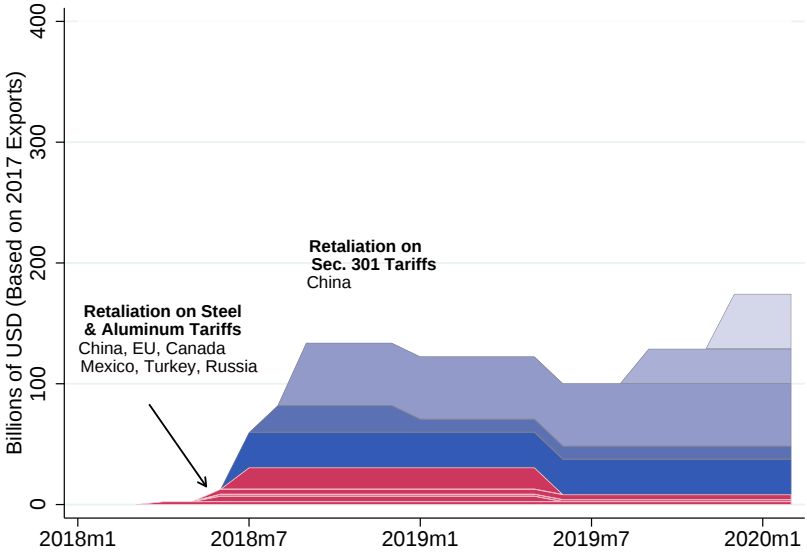

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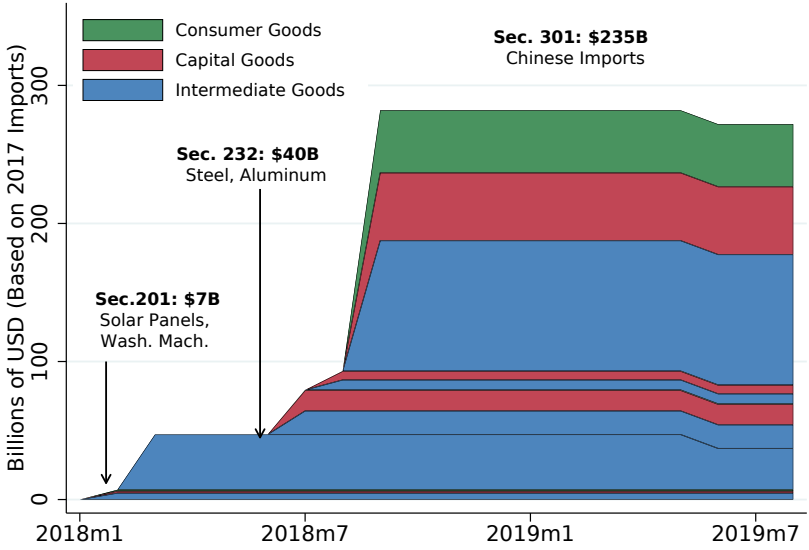

Data Sources

Construction of Tariff Impact Measures:

- Trade Flows: USITC
- Tariff Lists: USTR, various foreign government agencies, CMT Trade Law
- Annual Shipments: ASM (2016)
- Industry Cost Shares: BEA Input-Output Tables (2012 Benchmark)

Outcome Variables at the Monthly Frequency

- Output: Federal Reserve G.17
- Employment: CES program of the Bureau of Labor Statistics
- Prices: PPI from the Bureau of Labor Statistics

Three Channels of Tariff Exposure

Import Protection

Details

- What fraction of industry consumption comes from foreign sources now subject to new tariffs?
- Captures traditional **positive** channel of reshoring, etc

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Rising Input Costs

Details

- What fraction of an industry's costs come from foreign sources now subject to new tariffs?
- Captures **negative** impact of more expensive supply chain

Import Protection: Through September 2018

Rank	NAICS	Industry Description	New Tariff Import Share of Absorption
1	331313	Primary Aluminum Production	67%
2	3351	Electric Lighting Equipment	30%
3	3371	Household and Institutional Furniture and Kitchen Cabinet	24%
4	3344	Semiconductor and Other Electronic Component	21%
5	3311	Iron and Steel Mills and Ferroalloy Mfg	21%
6	33131B	Aluminum Sheet/Plate/Foil and Rolling/Drawing/Extruding	19%
7	3352	Household Appliance Manufacturing	18%
8	3359	Other Electrical Equipment & Component	16%
9	3160	Leather and Allied Product	15%
10	3332	Industrial Machinery	14%

Foreign Retaliation: Through September 2018

Rank	NAICS	Industry Description	New Tariff Export Share of Output
1	3346	Manufacturing and Reproducing Magnetic & Optical Media	8.6%
2	3160	Leather and Allied Product	7.7%
3	33131B	Aluminum Sheet/Plate/Foil & Rolling/Drawing/Extruding	7.7%
4	3311	Iron and Steel Mills and Ferroalloy Mfg	6.9%
5	3361	Motor Vehicle Manufacturing	4.9%
6	3352	Household Appliance Manufacturing	4.7%
7	3211	Sawmills and Wood Preservation	4.5%
8	3343	Audio and Video Equipment	4.3%
9	3253	Pesticide, Fertilizer, and Other Agricultural Chemical	4.1%
10	3341	Computer and Peripheral Equipment	3.9%

Rising Input Costs: Through September 2018

Rank	NAICS	Industry Description	New Tariff Share of Costs
1	33131B	Aluminum Sheet/Plate/Foil & Rolling/Drawing/Extruding	17.6
2	3312	Steel Product Mfg from Purchased Steel	8.4
3	3324	Boiler, Tank, and Shipping Container	8.3
4	3321	Forging and Stamping	7.4
5	331313	Primary Aluminum Production	7.2
6	331314	Secondary Smelting and Alloying of Aluminum	7.1
7	3323	Architectural and Structural Metals	5.3
8	3369	Other Transportation Equipment	5.0
9	3339	Other General Purpose Machinery	4.5
10	3352	Household Appliance Manufacturing	4.4

Estimating Equation

We estimate:

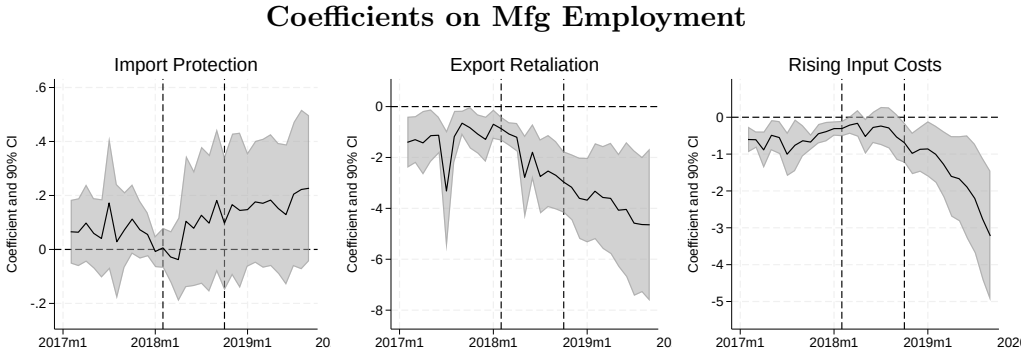
$$
\begin{aligned}
y_{it} = \quad & \alpha + \sum_t \gamma_t \mathbf{1}(M_t = t)(\text{Import Protection}_i) \ ... \\
& + \sum_t \theta_t \mathbf{1}(M_t = t)(\text{Input Cost}_i) \ ... \\
& + \sum_t \lambda_t \mathbf{1}(M_t = t)(\text{Foreign Retaliation}_i) \ ... \\
& + \sum_t \omega_t \mathbf{1}(M_t = t)(\text{Import Share}_i) \ ... \\
& + \sum_t \varphi_t \mathbf{1}(M_t = t)(\text{Export Share}_i) + \delta_i + \delta_t + \varepsilon_{it}
\end{aligned}
$$

where:

$$y_{it} = \{\text{Employment}, \ \text{Industrial Production}, \ \text{Producer Prices}\}$$

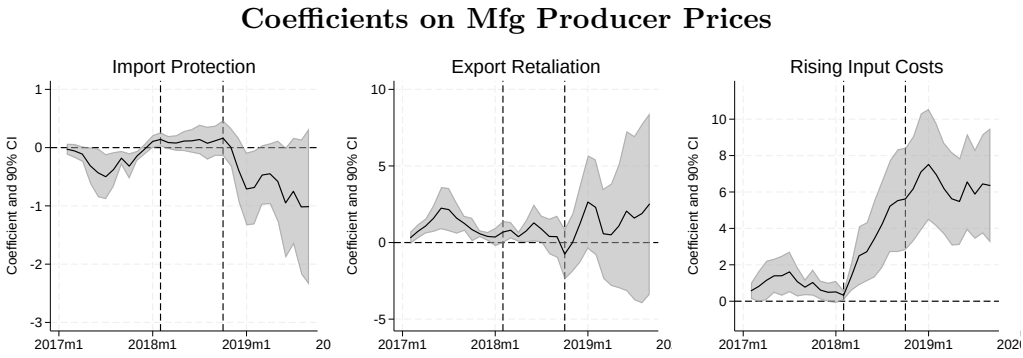
after detrending ▸ Details

Results: Employment: Detrended



- Imprecise positive impact from import protection
- Significant negative impacts from export retaliation and (with delay) rising input costs

Results: Producer Prices: Detrended



- Large and immediate impact on prices from rising input cost channel

Point Estimates of Cumulative Effect by Channel:

Variable	Employment	Industrial Production	Producer Prices
Import Protection	0.310*	-0.49	-1.27
	(0.171)	(1.006)	(0.758)
Foreign Retaliation	-4.48**	2.72	1.95
	(1.679)	(2.380)	(3.868)
Rising Input Costs	-3.09***	-1.22	6.54***
	(0.867)	(2.688)	(1.888)
Test of Joint Significance	-7.26***	1.03	7.23**
	(1.966)	(2.473)	(3.444)
Industry Fixed Effects	yes	yes	yes
Month Fixed Effects	yes	yes	yes
Number of Industries	76	84	82
Observations	2,508	2,772	2,706

Sources: Federal Reserve Board (FRB), U.S. Department of Labor, Bureau of Labor Statistics; authors' calculations.
Notes: Standard errors (in parentheses) are clustered by 3-digit NAICS industry. $* \ p < 0.10$, $** \ p < 0.05$, $*** \ p < 0.01$.

Quantifying the Effects: Employment

Channel	**Coefficient**	**Implied Effects**
Import Protection	0.31* (0.171)	+0.3%
Foreign Retaliation	-4.48** (1.679)	-1.0%
Rising Input Costs	-3.09*** (0.867)	-1.8%
Total		**-2.6 %** **(≈ 320K jobs)**

Additional Results

- Impacts on Industrial Production Details
  - Margins of Adjustment: Orders Backlogs and New Orders
- Decomposing Employment Margins Details
- Broader Effects of Tariffs Details
  - Is relative decline in Mfg employment easily absorbed by local labor markets?
  - Translate measures to county-level: impact on unemployment and labor force participation

Looking Ahead: Rising Input Costs from Mexico Tariffs

Rank	NAICS	Industry Description	New Tariff Share of Costs
1	3314	Nonferrous Metal Production and Processing	8.72
2	3361	Motor Vehicle Manufacturing	7.03
3	3362	Motor Vehicle Body and Trailer Manufacturing	4.57
4	3363	Motor Vehicle Parts Manufacturing	4.55
5	3331	Agriculture, Construction, and Mining Machinery	3.76
6	3353	Electrical Equipment Manufacturing	3.66
7	3334	HVAC and Commercial Refrigeration Equipment	3.32
8	3336	Engine, Turbine, and Power Transmission Equipment	2.97
9	3343	Audio and Video Equipment Manufacturing	2.76
10	3359	Other Electrical Equipment and Component	2.69

- Tariffs on Mexico would impact motor vehicles, electrical equipment and machinery sectors in the U.S.

Looking Ahead: Rising Input Costs from Canada Tariffs

Rank	NAICS	Industry Description	New Tariff Share of Costs
1	3313	Alumina and Aluminum Production and Processing	19.74
2	3241	Petroleum and Coal Products Manufacturing	15.74
3	3314	Nonferrous Metal Production and Processing	11.55
4	3369	Other Transportation Equipment Manufacturing	5.24
5	3315	Foundries	4.40
6	3221	Pulp, Paper, and Paperboard Mills	4.14
7	3219	Other Wood Product Manufacturing	3.95
8	3212	Veneer, Plywood, and Engineered Wood Product	3.81
9	3324	Boiler, Tank, and Shipping Container Manufacturing	3.72
10	3253	Pesticide, Fertilizer, and Other Agricultural Chemicals	3.26

- Tariffs on Canada would impact energy-intensive sectors, and wood/paper sectors in the U.S.

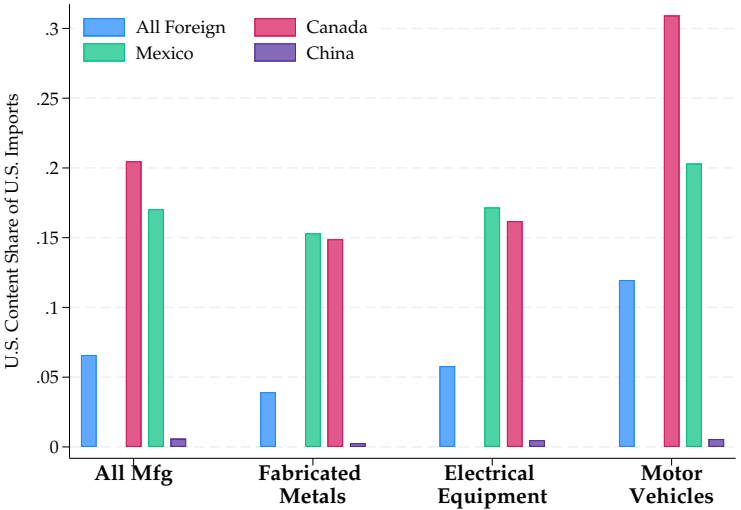
U.S. Content Embedded in U.S. Imports

- North American manufacturing is known to be highly integrated

U.S. Content Embedded in U.S. Imports

- North American manufacturing is known to be highly integrated
- One feature of such integration: inputs that cross borders multiple times...
- ... such as U.S. inputs that are used in Mexican production and re-exported back to the U.S.

Quantifying U.S. Content Embedded in U.S. Imports



- Canada/Mexico have *much* higher U.S. content embedded in what we import than most other countries, and especially China.

Source: Author's calculations using OECD Inter-Country Input-Output Database.

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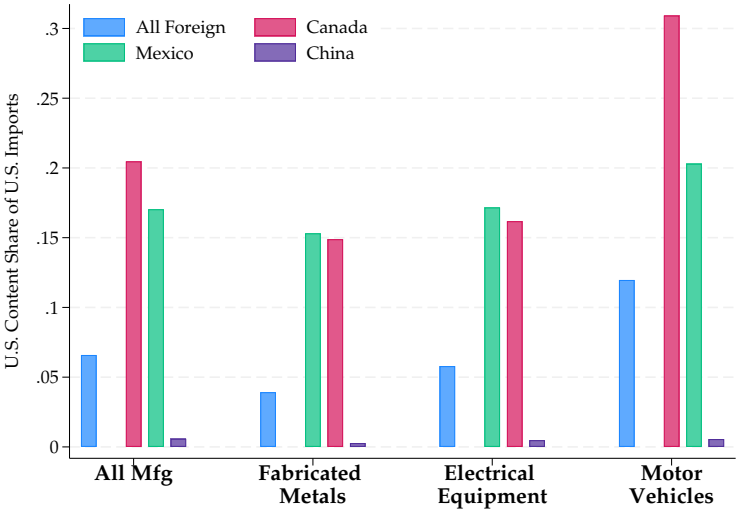

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- Canada/Mexico have *much* higher U.S. content embedded in what we import than most other countries, and especially China.
- Implications: for negative feedback to U.S. manufacturing
- and/or complicated documentation to quantify U.S. content

Conclusion

Looking back at the experience of the 2018-2019 tariffs

- We argue that in a globally connected manufacturing landscape, a full picture of the effects of tariffs must account for multiple channels:
  - Import protection
  - Foreign retaliation
  - Rising input costs
- We find that 2018-2019 tariffs are associated with lower employment and higher producer prices, with the effects primarily transmitted via rising input costs

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- We find that 2018-2019 tariffs are associated with lower employment and higher producer prices, with the effects primarily transmitted via rising input costs

Looking ahead...

- Our framework highlights several U.S. manufacturing sectors that could feel the brunt of new tariffs on Canada and Mexico.
- And, round-trip trade linkages between these countries could amplify the negative impacts of tariffs on U.S. manufacturing

Additional Slides

Import Protection

Back

Measure the share of domestic consumption that has been affected by new tariffs on imported products.

- Let Ω^I be the list of U.S. imported product-country pairs (pc) subject to new tariffs.
- Q_i is industry shipments
- imp_i and exp_i are industry imports and exports

Then, the **Import Protection** measure we use is the new tariff import share of domestic absorption:

$$\textbf{Import Protection} = \frac{\sum_{pc \in \Omega^I} imp_{ipc}}{Q_i + imp_i - exp_i} \tag{1}$$

Retaliatory Tariffs

Back

Measure the share of U.S. output that has been affected by retaliatory tariffs on U.S. exports

- Let Ω^E be the list of U.S. exported product-country pairs (pc) subject to retaliatory tariffs against the United States.
- Q_i is industry shipments

Then, the **Retaliatory Tariff Share of Output** is given by:

$$\textbf{Retaliatory Tariff} = \frac{\sum_{pc \in \Omega^E} exp_{ipc}}{Q_i} \tag{2}$$

Rising Input Costs

Back

Measure the share of a U.S. industry's costs that are affected by U.S. tariffs on imported intermediate inputs

- Let Ω^I be the list of U.S. imported product-country pairs (pc) subject to new tariffs.
- use_{ij} is the value of commodity j used in industry i production.
- M_i is total material inputs and $Comp_i$ is employee compensation.
- Q_j is U.S. output of commodity j

Then, the measure of **Rising Input Costs** is the new tariff share of costs:

$$\textbf{Rising Input Costs} = \sum_j \underbrace{\frac{use_{ij}}{M_i + Comp_i}}_{\substack{\text{Commodity } j \\ \text{share of costs in} \\ \text{industry } i}} \underbrace{\frac{\sum_{pc \in \Omega^I} imp_{jpc}}{Q_j + imp_j}}_{\substack{\text{New tariff import} \\ \text{share of domestic} \\ \text{supply of commodity } j}} \tag{3}$$

De-Trending

Back

Question is how to account for differential pre-trends in that data. We use two approaches

1. Remove linear trend (over year 2017) from each dependent variable

2. Follow Finkelstein (2007) and difference out pre-trend path for each coefficient. Specifically:

$$\Delta y_{it}^{\gamma} = \quad (\overline{\gamma}_{\text{Jun-Aug19}} - \overline{\gamma}_{\text{Mar18-May18}}) - (\overline{\gamma}_{\text{Mar18-May18}} - \overline{\gamma}_{\text{Feb17-Apr17}}) \tag{4}$$

Margins of Employment Adjustment

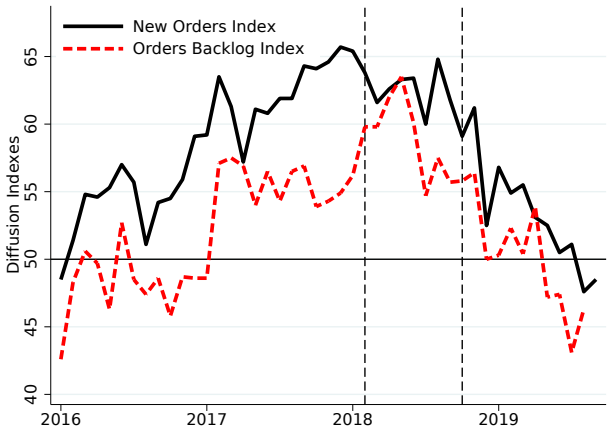
Back

Variable	Hires (1)	Separations (2)
Import Protection	0.469	0.156
	(1.540)	(1.511)
Export Retaliation	-5.190	13.155***
	(9.385)	(4.350)
Rising Input Costs	-17.351**	3.369
	(6.336)	(2.160)
Industry Fixed Effects	yes	yes
Quarter Fixed Effects	yes	yes
Number of Industries	76	76
Observations	836	836

Sources: U.S. Census Bureau; authors' calculations.
Standard errors (in parentheses) are clustered by 3-digit NAICS industry. $* \ p < 0.10$, $** \ p < 0.05$, $*** \ p < 0.01$.

Employment vs IP

Back



- Lack of impact to industrial production potentially puzzling.

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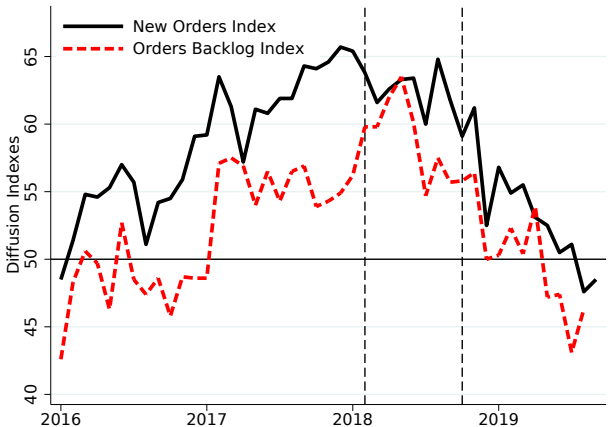
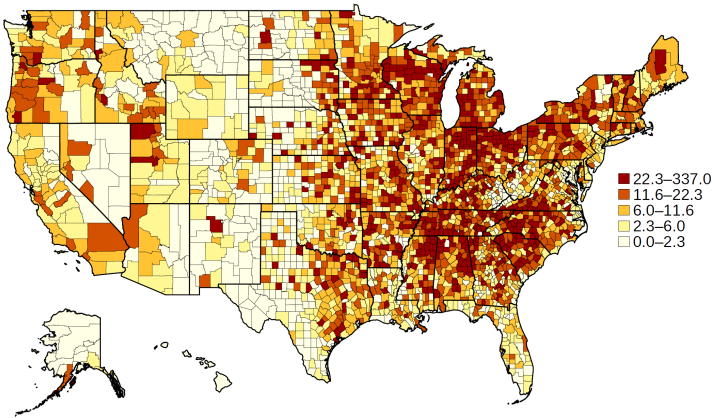


- Lack of impact to industrial production potentially puzzling.
- We find evidence that this is because tariffs were imposed when manufacturers held record levels of order backlogs

County-Level Analysis of Labor Markets



- Translate industry-level measures to county-level using 2016 County Business Patterns
- Areas receiving highest import protection are clustered in industrial Midwest and Southeast

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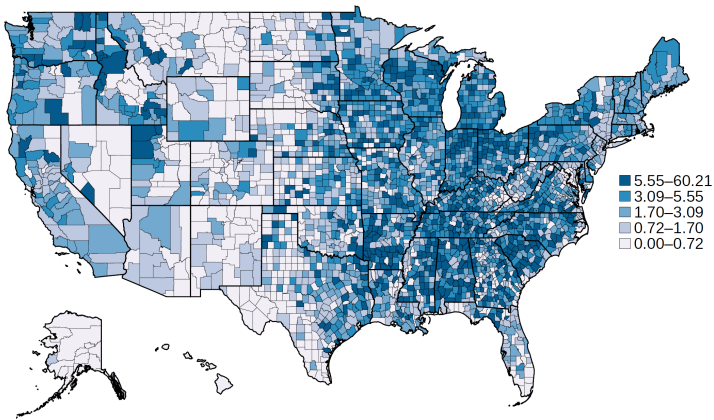

- Yet, these areas are also most exposed to foreign retaliation (correlation 0.52)

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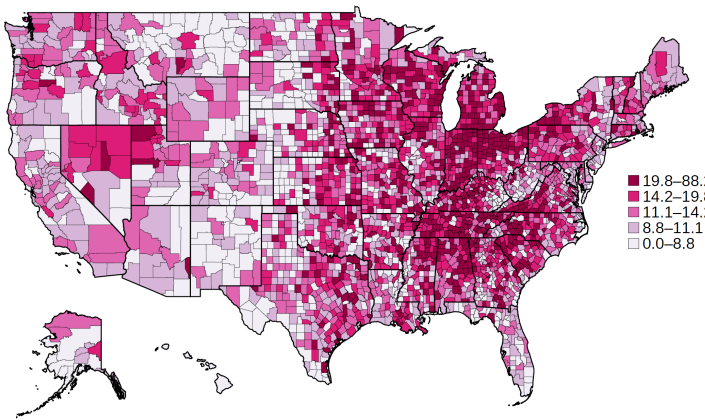

- And also most exposed to rising input costs (correlation 0.73)

Labor Market Effects

Back

Variable	Unemployment Rate		Labor Force Participation	
	(1)	(2)	(3)	(4)
Import Protection	9.76*	9.95*	0.47	0.47
	(5.48)	(5.85)	(0.72)	(1.11)
Export Retaliation	51.67*	52.70*	1.42	0.98
	(31.08)	(29.93)	(3.16)	(3.48)
Rising Input Costs	64.18***	64.08**	-8.57***	-9.01***
	(17.81)	(27.10)	(2.60)	(2.23)
Manufacturing Share Controls	yes	yes	yes	yes
County Fixed Effects	yes	N.A.	yes	N.A.
Month Fixed Effects	yes	yes	yes	yes
Number of Counties	3,131	N.A.	3,131	N.A.
Number of Industries	N.A.	250	N.A.	250
Observations	103,323	8,250	103,323	8,250

Sources: U.S. Department of Labor, Bureau of Labor Statistics; authors' calculations.
Notes: Columns (1) and (3) display results of the county-level approach. Columns (2) and (4) are the equivalent regressions translated to a shock-level (industry) basis following Borusyak et al (2022). Standard errors (in parentheses) are clustered at the state-level in columns (1) and (3), and NAICS-3 level in columns (2) and (4). $* \ p < 0.10$, $** \ p < 0.05$, $*** \ p < 0.01$.