

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

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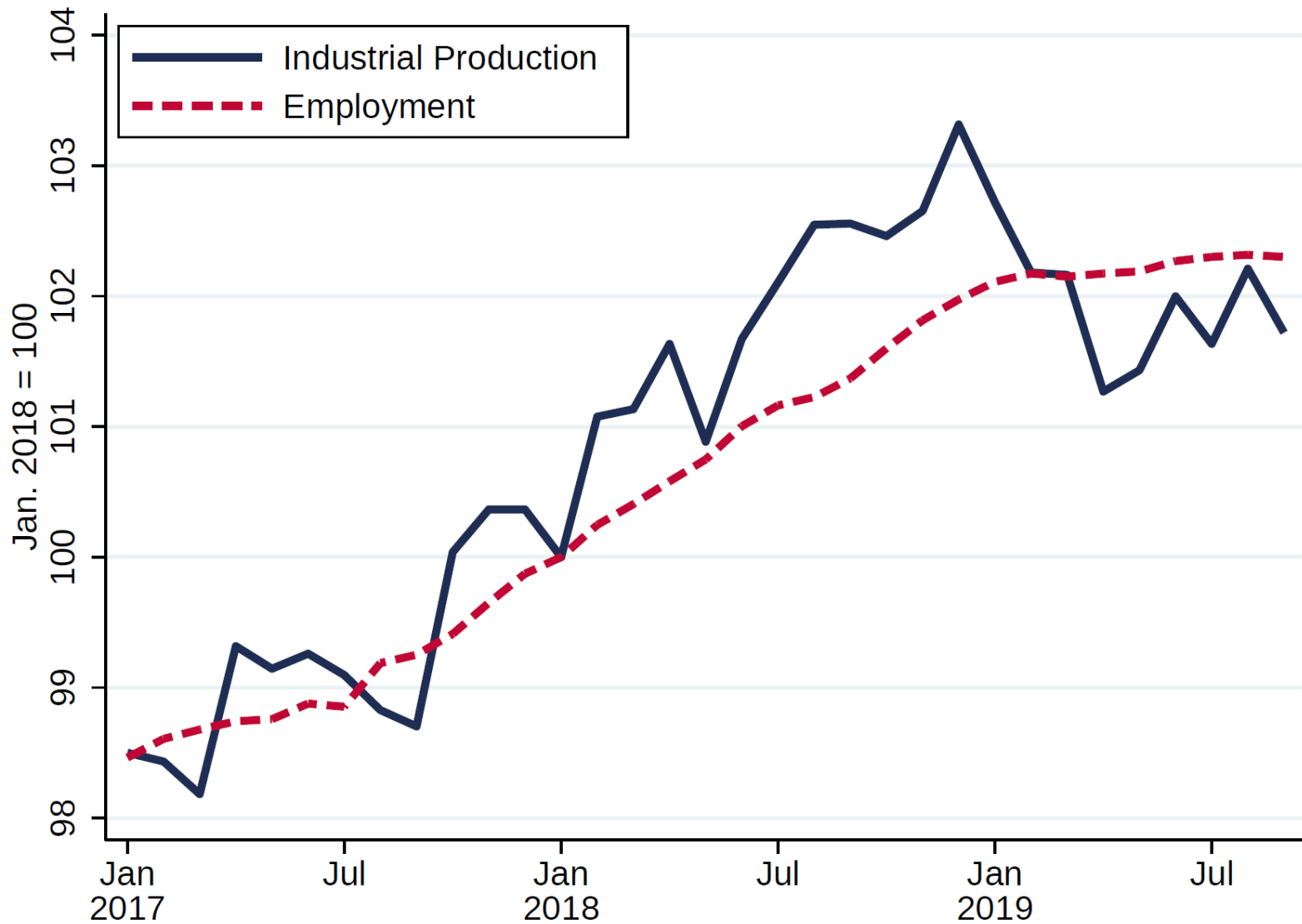
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Introduction

- Beginning in 2018, trade tensions between the U.S. and its trading partners led to the imposition of tariffs covering hundreds of billions of dollars of intl. trade
- Goals have evolved, but key aim of U.S. tariffs was to boost manufacturing sector
- Growing evidence of negative effects of recent tariffs on welfare; but effect on U.S. manufacturing sector is unclear
- Tariffs can affect domestic output, employment, and producer prices through several 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
- With tariff increases of this scale unprecedented in a world of global supply chains, effects of the trade war are unclear
- While there was a temporary “truce” in the U.S.-China trade war, increasing hostility related to COVID-19 raises the risk of backsliding, more tariff increases

Measures of Manufacturing Activity: Jan. 2017 – Sep. 2019



Introduction

- This paper: A first look at the effects of 2018-2019 tariffs on the U.S. manufacturing sector
- What we do:
 - Construct industry-level measures of three channels through which recent tariffs could affect the manufacturing sector
 - Import protection; rising input costs; export retaliation
 - Assess the relationship between these measures and aspects of manufacturing activity
 - Employment, output, producer prices, unemployment rates
- What we find:
 - 2018-2019 tariffs associated with:
 - Lower manufacturing employment: Small positive effect of import protection more than offset by rising input costs, foreign retaliation
 - Higher producer prices: Solely due to rising input cost channel
 - Higher unemployment: Lost emp. not made up in other sectors

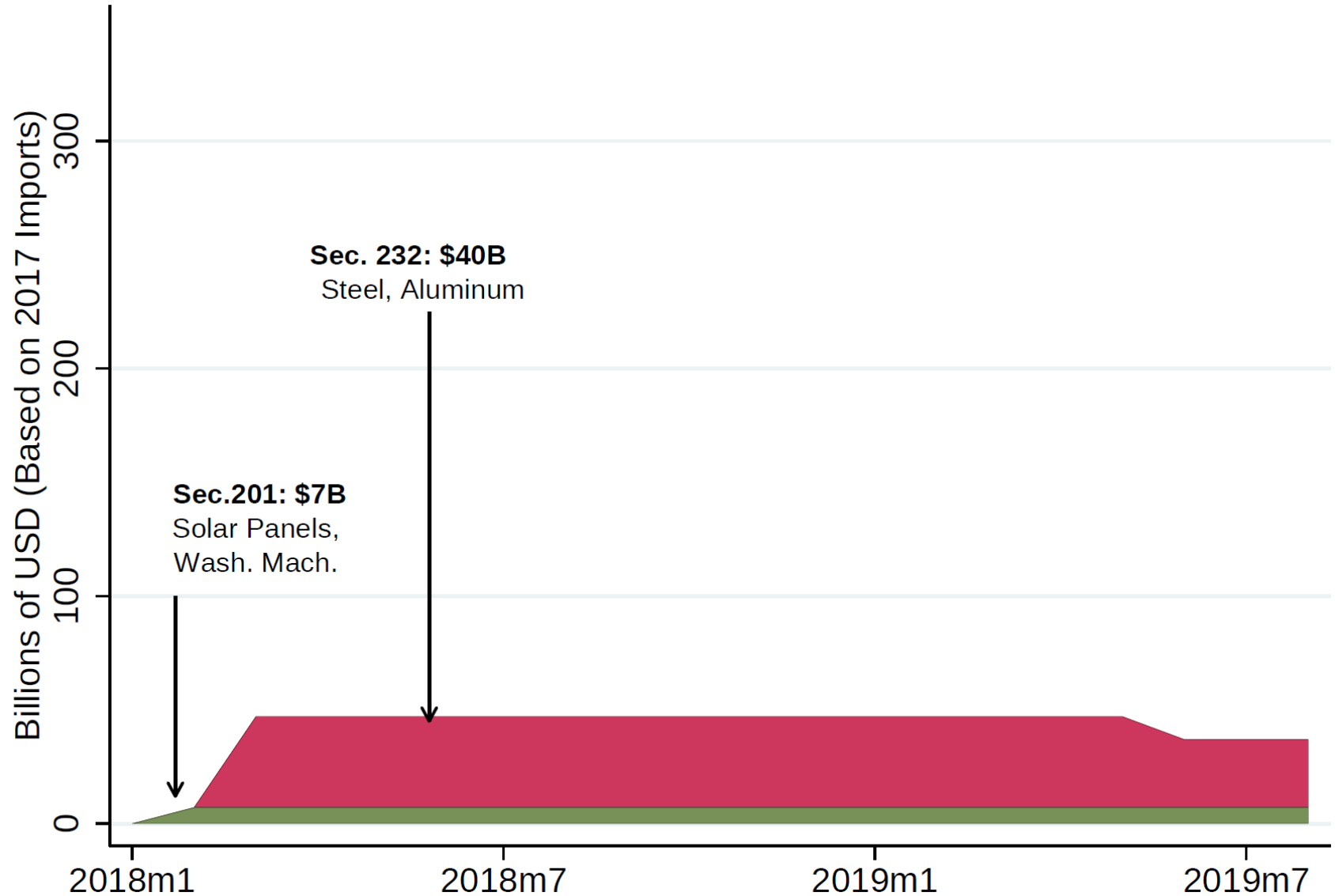
Related Literature

- Analysis of 2018-2019 U.S. trade policy
 - **Import/Consumer Prices:** Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2019); Amiti, Redding, and Weinstein (2019); Flaaen, Hortaçsu, and Tintelnot (2019); Cavallo et al. (2019)
 - **U.S. Exports:** Handley, Kamal, and Monarch (2020)
 - **Geographic Analysis:** Waugh (2019) [consumption]; Goswami (2020) [employment growth]; Blanchard, Bown, and Chor [election voting]
 - **Stock Performance:** Huang et al. (2019), Amiti et al. (2020)
 - **Uncertainty:** Caldara et al. (2019)
- Effects of tariffs along supply chains
 - Amiti and Konings (2007); Topalova and Khandelwal (2011); Bown et al. (2020); Grossman and Helpman (2020); Barattieri and Cacciatore (2020)
- The channels we examine are not novel, but their importance given the rapid growth of global trade linkages is:
 - Optimal tariffs with export retaliation: Kaldor (1940); Johnson (1953)
 - Effects of tariffs on intermediate inputs: Balassa (1965); Corden (1966)

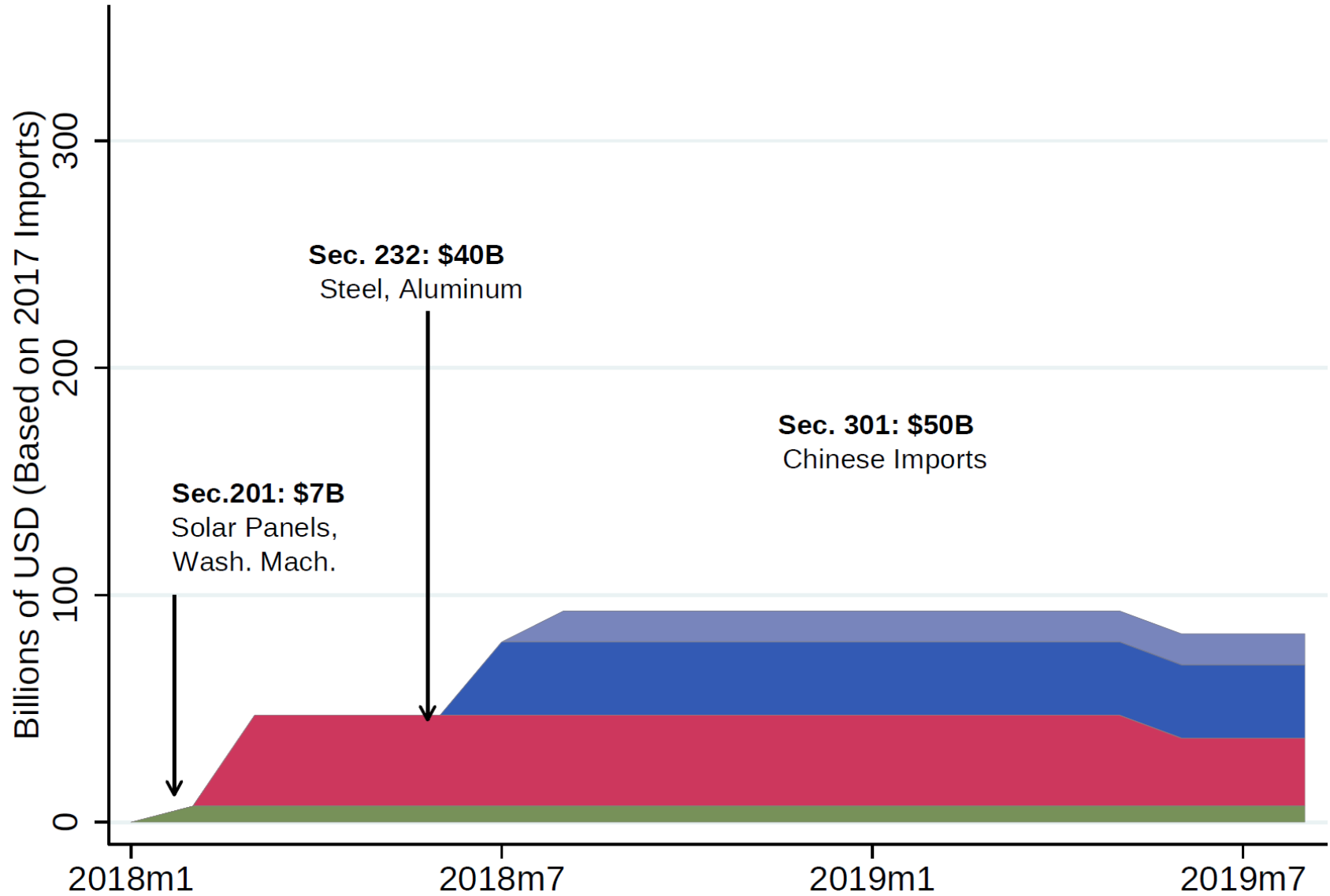
Outline

- Background on 2018-2019 tariffs
- Data and construction of measures of exposure to trade policy changes
- Empirical strategy and results
- Conclusion

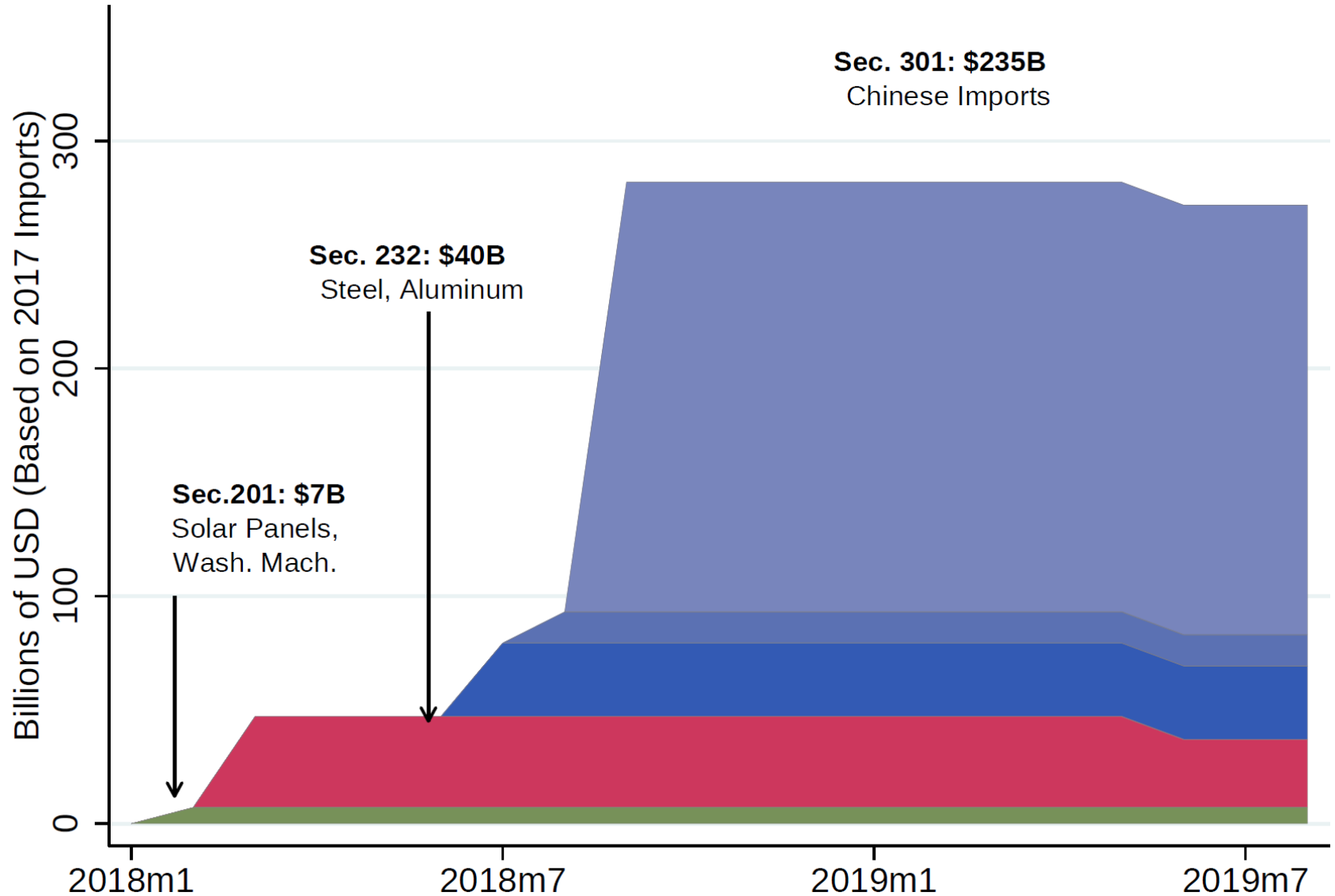
Timeline of New U.S. Import Tariffs



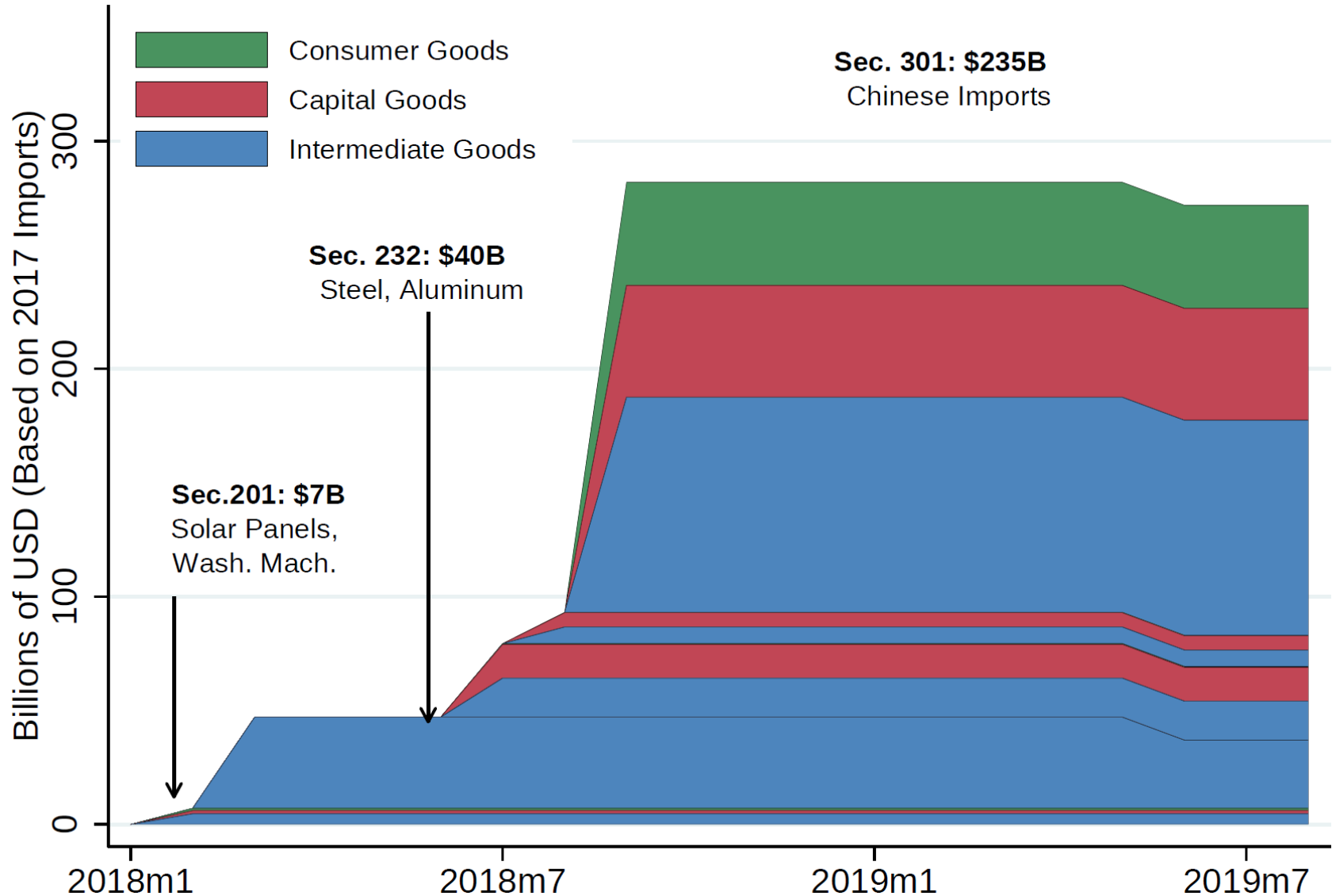
Timeline of New U.S. Import Tariffs



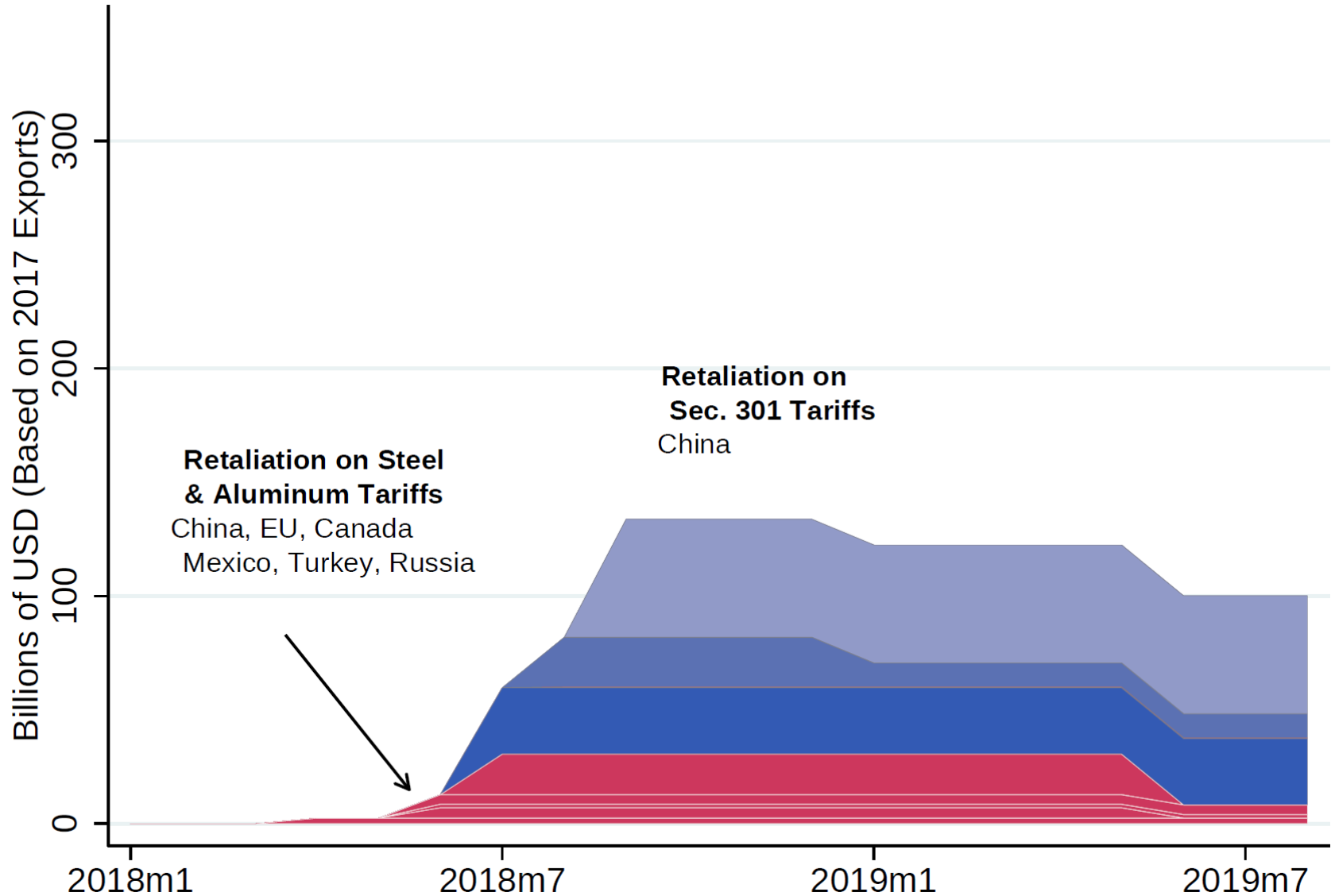
Timeline of New U.S. Import Tariffs



Timeline of New U.S. Import Tariffs



Timeline of New Foreign Retaliatory Tariffs



Data Sources

- Construction of Industry-Level Tariff Impact Channels
 - Trade Flows: U.S. Census Bureau
 - Annual Shipments: U.S. Census Bureau (2016 ASM)
 - Tariff Product Lists: USTR, Various Foreign Government Agencies; CMT Trade Law
 - Industry Cost Shares: Bureau of Economic Analysis (2012 IO Tables)
- Monthly Outcome Variables
 - Output: Federal Reserve (G.17)
 - Employment: Bureau of Labor Statistics (CES)
 - Producer Prices: Bureau of Labor Statistics (PPI)
- Level of aggregation: Roughly 4-digit NAICS (between 76 and 84 industries depending on dependent variable)

Import Protection

- Measure the share of industry-level domestic absorption that has been affected by new import tariffs.
 - 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 is the new tariff import share of domestic absorption:

$$Import\ Protection_i = \frac{\sum_{pc \in \Omega^I} imp_{ipc} \Delta \tau_{ipc}}{Q_i + imp_i - exp_i}$$

Import Protection (though September 2018)

Rank	NAICS	Industry Description	Import Protection Measure
1	3351	Electric Lighting Equipment	7.4%
2	331313	Primary Aluminum Production	6.7%
3	3371	Household and Institutional Furniture and Kitchen Cabinet	6.0%
4	3344	Semiconductor and Other Electronic Component	5.4%
5	3311	Iron and Steel Mills and Ferroalloy Mfg	5.2%
6	3352	Household Appliance Manufacturing	4.3%
7	3359	Other Electrical Equipment & Component	4.1%
8	3160	Leather and Allied Product	3.7%
9	3332	Industrial Machinery	3.6%
10	3322	Cutlery and Handtool Manufacturing	3.6%

Foreign Retaliation

- Measure the share of industry-level output subject to retaliatory tariffs on U.S. exports:
 - Let Ω^E be the list of U.S. exported product-country pairs (pc) subject to the retaliatory tariffs against the United States.
 - Q_i is industry shipments
- Then, the **Retaliatory Tariff** Share of Output is given by:

$$\text{Retaliatory Tariff} = \frac{\sum_{pc \in \Omega^E} \exp_{ipc} \Delta \tau_{ipc}}{Q_i}$$

Foreign Retaliation

Rank	NAICS	Industry Description	Foreign Retaliation Measure
1	3346	Manufacturing and Reproducing Magnetic & Optical Media	1.71%
2	3311	Iron and Steel Mills and Ferroalloy Mfg	1.67%
3	3361	Motor Vehicle Manufacturing	1.23%
4	3160	Leather and Allied Product	1.06%
5	33131B	Aluminum Sheet/Plate/Foil & Rolling/Drawing/Extruding	0.96%
6	3211	Sawmills and Wood Preservation	0.95%
7	3343	Audio and Video Equipment	0.84%
8	3341	Computer and Peripheral Equipment	0.79%
9	3369	Other Transportation Equipment	0.74%
10	3352	Household Appliance Manufacturing	0.71%

Rising Input Costs

- Measure the share of industry-level input costs subject to U.S. tariffs
 - 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 's production
 - M_i is the 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:

$$Rising\ Input\ Costs_i = \sum_j \frac{use_{ij}}{M_i + Comp_i} \frac{\sum_{pc \in \Omega^I} imp_{ipc} \Delta \tau_{jpc}}{Q_j + imp_j}$$

Commodity j share
of costs in industry i

New tariff import
share of domestic
supply of commodity j

Rising Input Costs

Rank	NAICS	Industry Description	Rising Input Cost Measure
1	3312	Steel Product Mfg from Purchased Steel	2.23%
2	33131B	Aluminum Sheet/Plate/Foil & Rolling/Drawing/Extruding	1.94%
3	3321	Forging and Stamping	1.86%
4	3324	Boiler, Tank, and Shipping Container	1.53%
5	3323	Architectural and Structural Metals	1.39%
6	3332	Industrial Machinery Manufacturing	1.29%
7	3339	Other General Purpose Machinery Manufacturing	1.29%
8	3352	Household Appliance Manufacturing	1.26%
9	3369	Other Transportation Equipment	1.26%
10	3363	Motor Vehicle Parts Manufacturing	1.16%

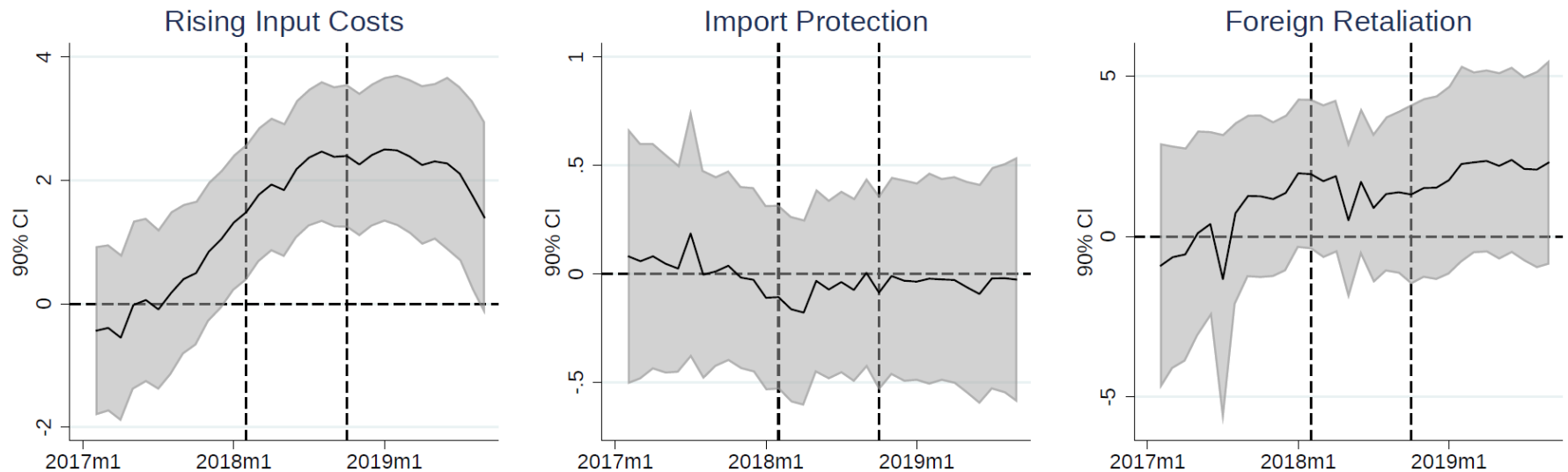
Estimating Equation

$$\begin{aligned} y_{it} = & \alpha + \sum_t \gamma_t 1\{\text{month} = t\} \times \text{Import Protection}_i \\ & + \sum_t \gamma_t 1\{\text{month} = t\} \times \text{Input Cost}_i \\ & + \sum_t \lambda_t 1\{\text{month} = t\} \times \text{Foreign Retaliation}_i \\ & + \sum_t \omega_t 1\{\text{month} = t\} \times \text{Import Share}_i \\ & + \sum_t \omega_t 1\{\text{month} = t\} \times \text{Export Share}_i \\ & + \delta_i + \delta_t + \varepsilon_{it} \end{aligned}$$

- $y_{it} = \{\text{Employment}, \text{Industrial Production}, \text{Producer Prices}\}$
- Interact full set of month dummies with each tariff channel
- Also interactions with import share of absorption and export share of output
- Include industry and month fixed effects

Tariffs and Employment (Non-Detrended)

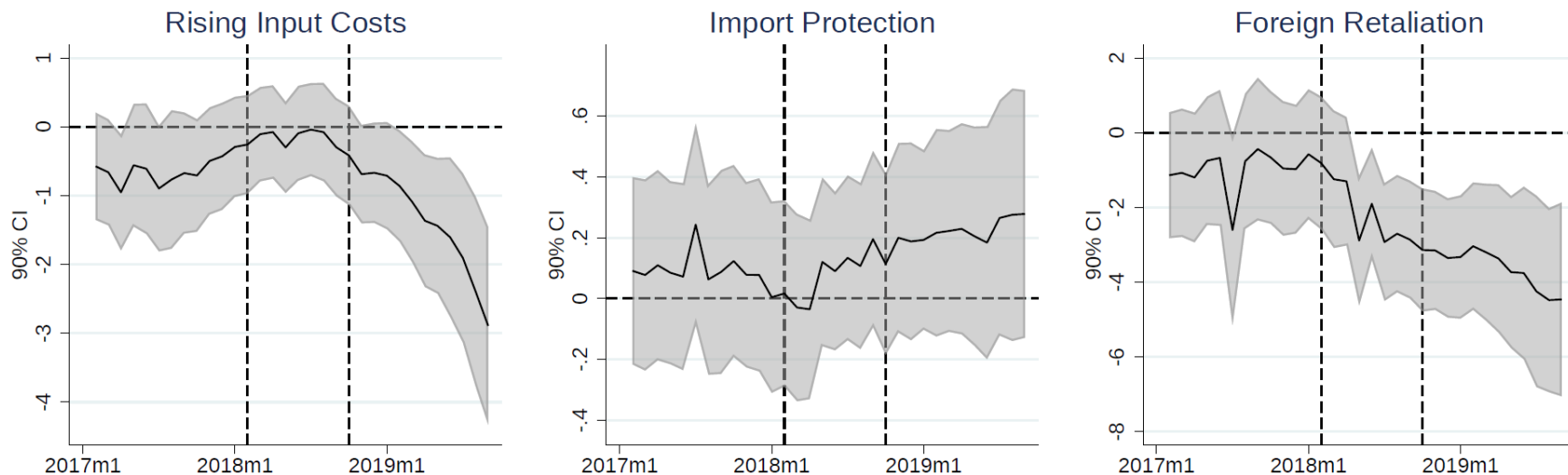
(a) Employment



- Notable pre-existing trends for more- vs. less-exposed industries
- There are also apparent breaks in those trends as tariffs put in place
- Address this by subtracting linear trend for each industry based on period from Jan. 2017 to Jan. 2018, before tariffs announced

Tariffs and Employment (Detrended)

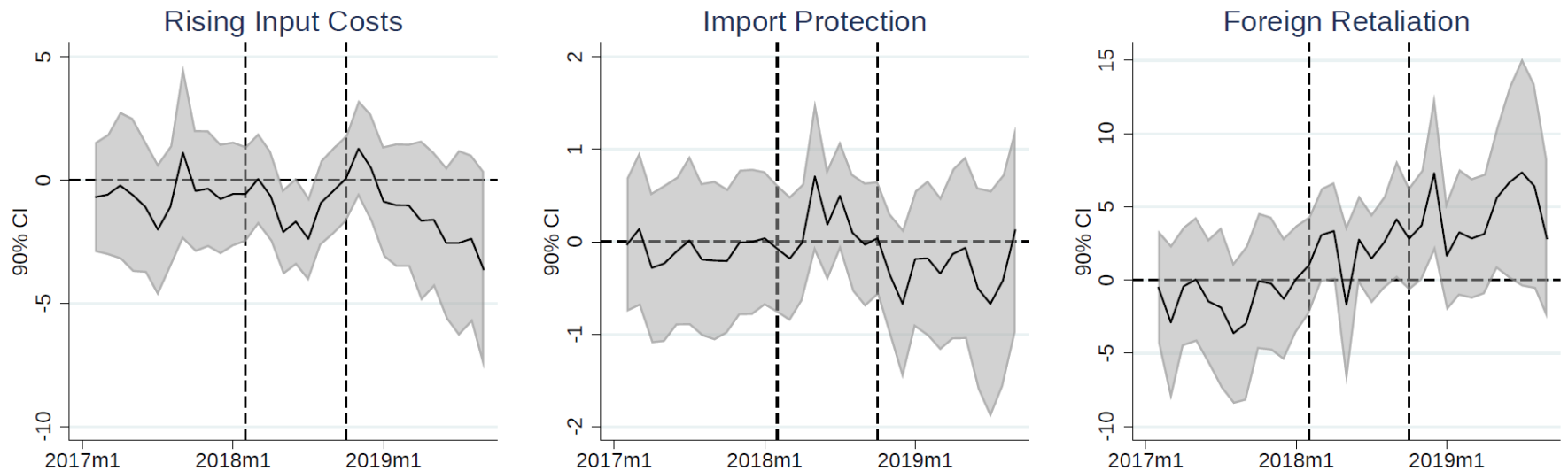
(a) Employment



- **Rising Input Costs**: Industries more exposed to rising input costs channel experience relative reductions in employment
- **Import Protection**: More-protected industries appear to experience modest relative increase in employment, but not precisely estimated
- **Foreign Retaliation**: Industries more exposed to foreign retaliation experience relative reductions in employment

Tariffs and IP (Detrended)

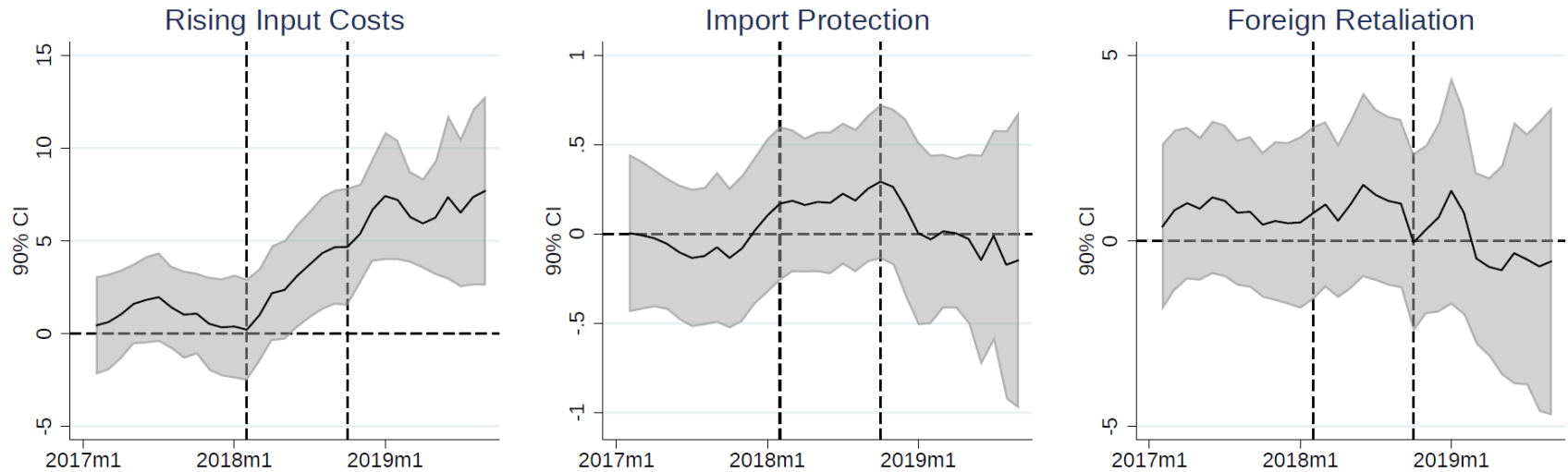
(b) Industrial Production (Output)



- Don't find strong evidence of relationship between tariffs and IP
- There is some evidence of effect of rising input costs, but it is sensitive to time period considered

Tariffs and PPI (Detrended)

(c) Producer Price Index



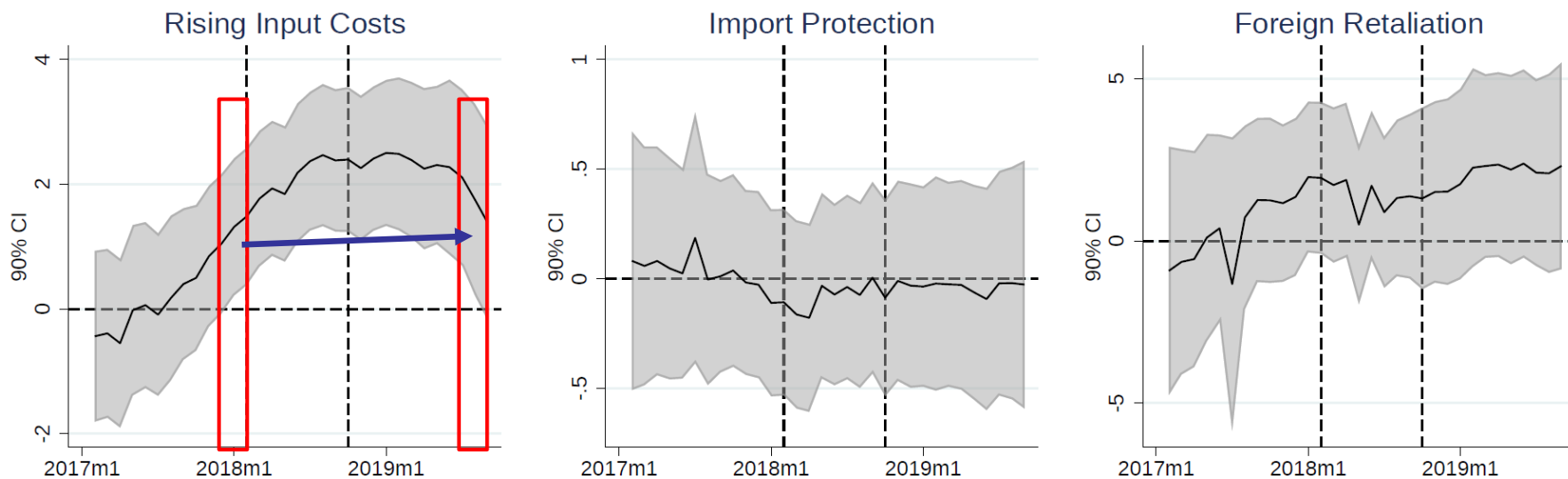
- Tariffs associated with relative increases in prices
 - Relationship driven entirely by effect of rising input costs channel

Accounting for Pre-Trend: Point Estimates

- Second approach to account for pre-trend follows Finkelstein (2007) :

$$\Delta y_{it} = (\bar{y}_{Jul19-Sep19} - \bar{y}_{Dec17-Feb18}) - (\bar{y}_{Dec17-Feb18} - \bar{y}_{Feb17-Apr17})$$

(a) Employment

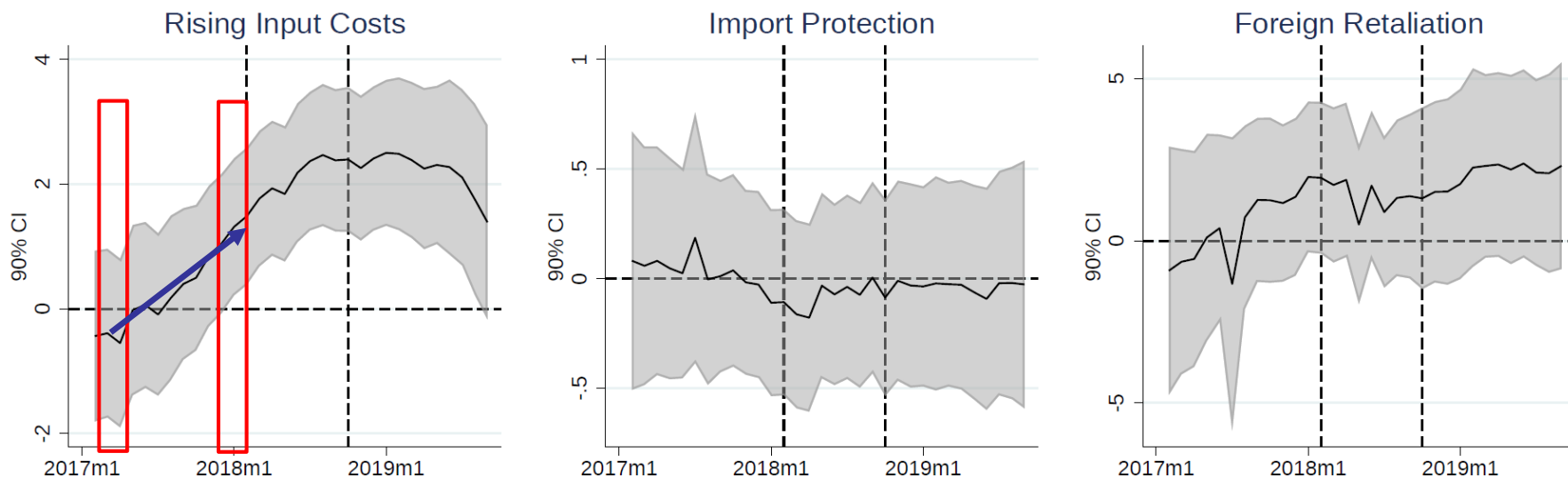


Accounting for Pre-Trend: Point Estimates

- Second approach to account for pre-trend follows Finkelstein (2007) :

$$\Delta y_{it} = (\bar{y}_{Aug19toJul19} - \bar{y}_{-3to0 \text{ from tariff}}) - (\bar{y}_{-3to0 \text{ from tariff}} - \bar{y}_{Feb17toApr17})$$

(a) Employment



Alternative Approach: Point Estimates

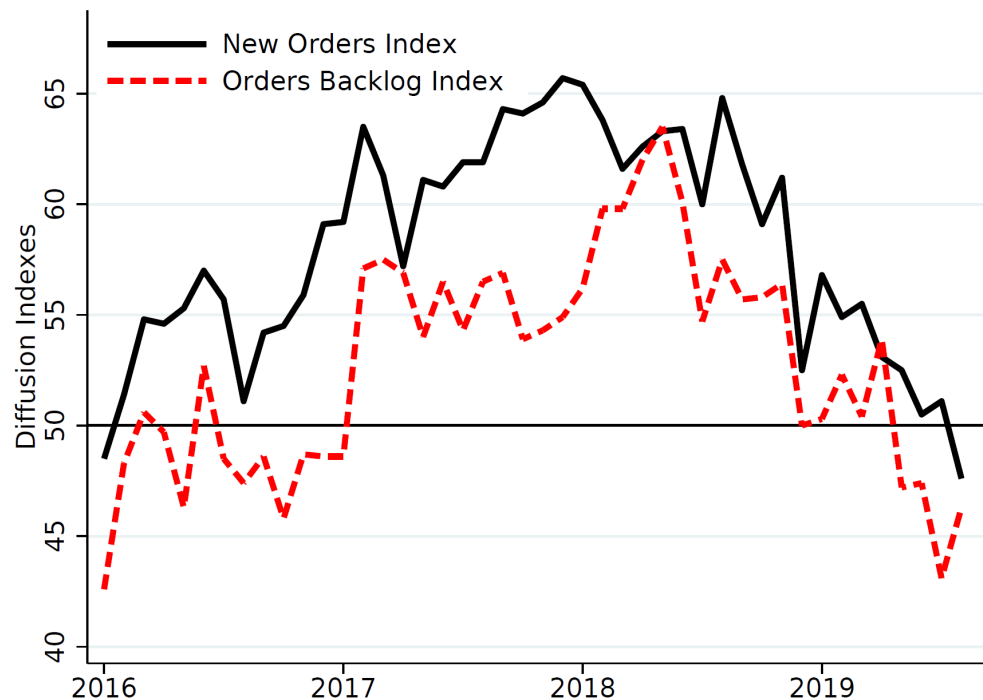
Variable	Employment	Industrial Production	Producer Prices
Import Protection	0.356 (0.321)	-0.400 (0.623)	-0.413 (0.484)
Rising Input Costs	-2.855*** (0.859)	-1.952 (1.808)	7.653*** (1.984)
Foreign Retaliation	-4.263** (2.084)	3.286 (2.441)	-0.850 (1.801)
Industry Fixed Effects	yes	yes	yes
Number of Industries	76	84	82
Observations	2,508	2,772	2,706

- Relationships mirror those shown visually in more general regression
- Economic Significance (compare 75th, 25th percentile industries):
 - Imp. protect: +0.4 ppt
 - Input costs: -1.8 ppt
 - Retaliation: -1.0 ppt
- **Emp: -2.4 percent**
- **PPI: +3.9 percent**

Trade Policy Uncertainty

Employment versus IP

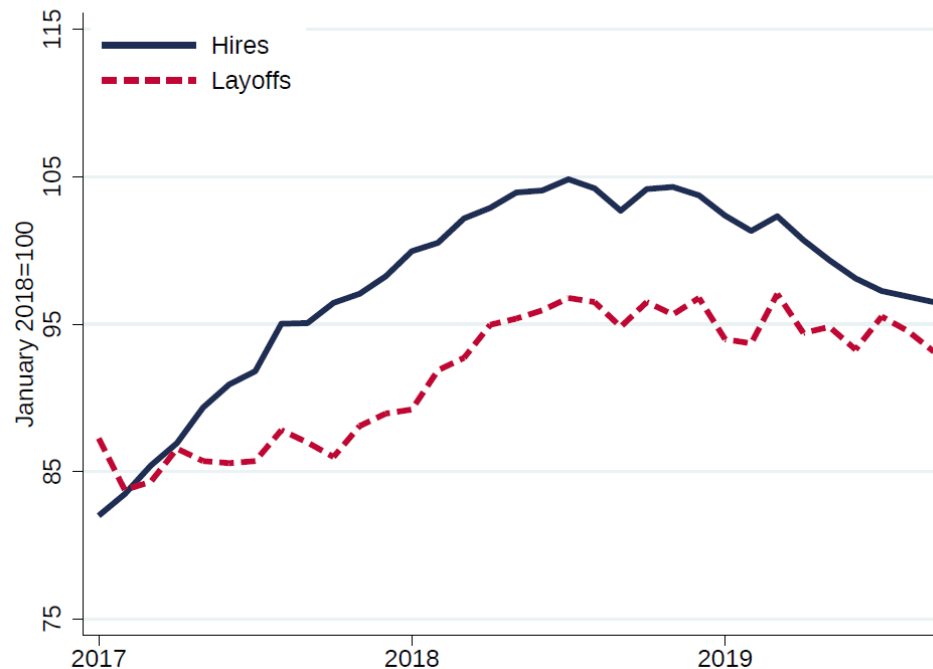
- The lack of a relationship for industrial production is notable given the strong relationship present for employment
- We find evidence that this difference arises due to timing: tariffs were imposed at a time that manufacturers' held record levels of order backlogs
 - Order backlogs had built up in late 2017 and early 2018
 - New orders plunged as tariffs were put into place



Employment versus IP

- How would firms respond to big orders backlog, but low future demand?
- One possibility: Continue to produce at prior levels (to fulfill contracts), but hold off on hiring that would have otherwise occurred with orders backlogs
- We see evidence for this in aggregate JOLTS data for manufacturing sector

(b) Hires and Layoffs



Employment versus IP

- Can look at the relationship more formally using industry-quarter-level data from the Quarterly Workforce Indicators
 - Census of virtually all employer-employee linkages
- Also provides information on margins of employment adjustment

Variable	Hires	Separations
Import Protection	0.487 (1.210)	-0.029 (1.273)
Rising Input Costs	-15.669*** (3.960)	2.696 (3.218)
Foreign Retaliation	-7.313 (9.575)	11.848 (7.143)
Industry Fixed Effects	yes	yes
Number of Industries	76	76
Observations	836	836

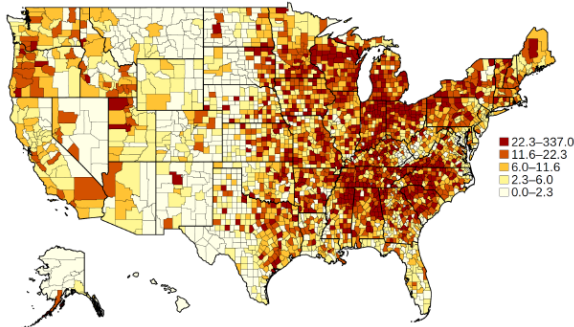
Broader Effects of Tariffs on Manufacturing

Examine whether tariffs on manufacturing sector have broader implications

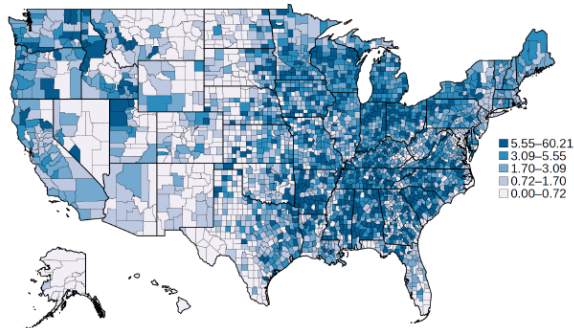
1. **Effects on Nonmanufacturing**: Do manufacturing tariffs have spillover effects to downstream nonmanufacturing industries?
 - We don't find much evidence for this; unsurprising given the much higher exposure for manufacturing industries, higher level of aggregation in data for nonmanufacturing sector
2. **Effects on Broader Labor Market**: Does the relative decline in employment for manufacturing workers lead to increased unemployment?

Spillovers to Broader Labor Market Effects

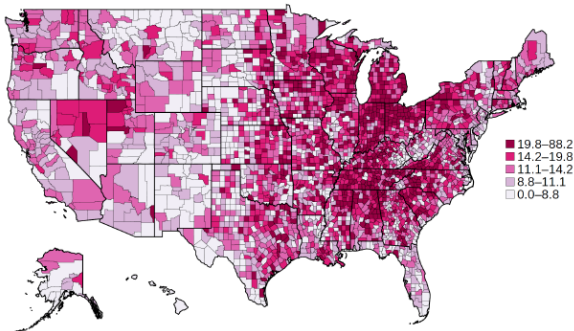
(a) Manufacturing Import Protection, by County



(b) Foreign Retaliation on Manufacturing, by County

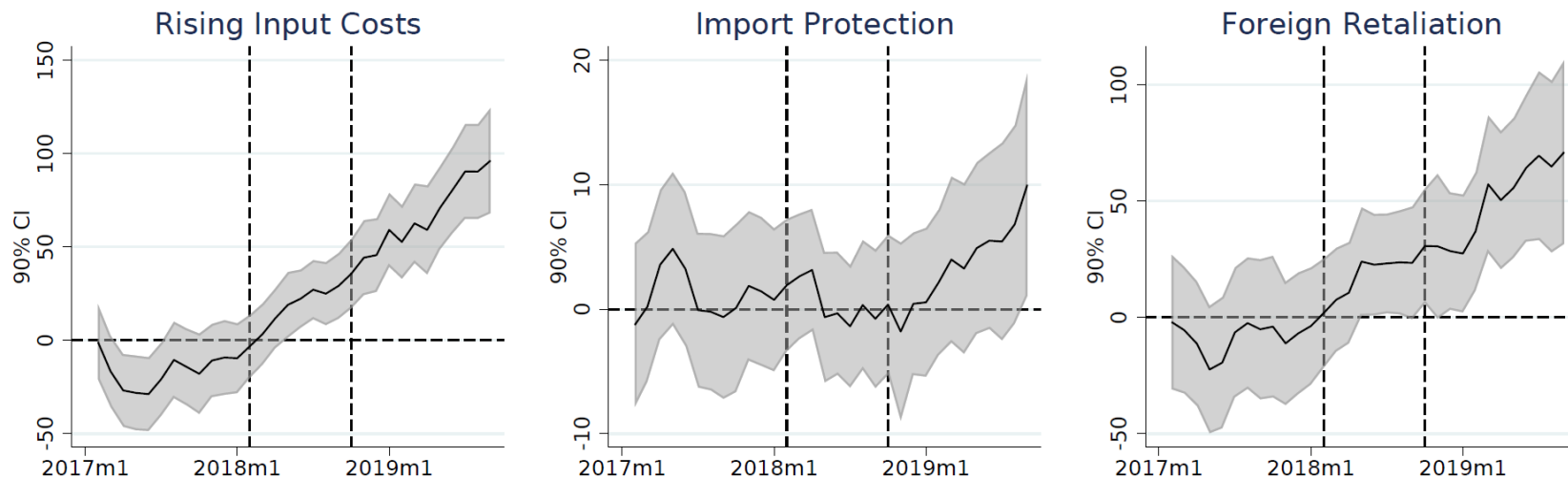


(c) Rising Manufacturing Input Costs, by County



- If exposure to tariffs is concentrated in particular geographic areas, labor market effects may be more acute
- We calculate county-level measures of each of the three channels using the 2016 County Business Patterns
- Importantly, some of the areas that receive the highest levels of import protection are clustered in the industrial Midwest and Southeast
- However, those same areas are also most exposed to rising input costs and foreign retaliation

Spillovers to Broader Labor Market Effects



- Results are consistent with employment effects
- Higher exposure to rising input costs and foreign retaliation is associated with a relative increase in county-level unemployment
- A county at the 75th percentile of exposure to all three measures experiences a 0.16 percentage point increase in unemployment rate, relative to county at 25th percentile
- Suggests that relative decline in manufacturing employment is not readily absorbed by the labor market

Discussion

- Results in this paper focus on short-term effects of tariffs, and longer-run effects could be qualitatively different
- U.S. manufacturing activity may expand as firms adjust supply chains to avoid import tariffs (or threat of future tariffs)
- That said, the U.S. is not typically the immediate destination for production relocation from China due to increased tariffs (Flaaen et al. 2019)
- Responses will also depend on whether firms view tariffs as being short-term or long-term
- With increasing tensions with China over COVID-19, they may view tariffs as being here to stay

Conclusion

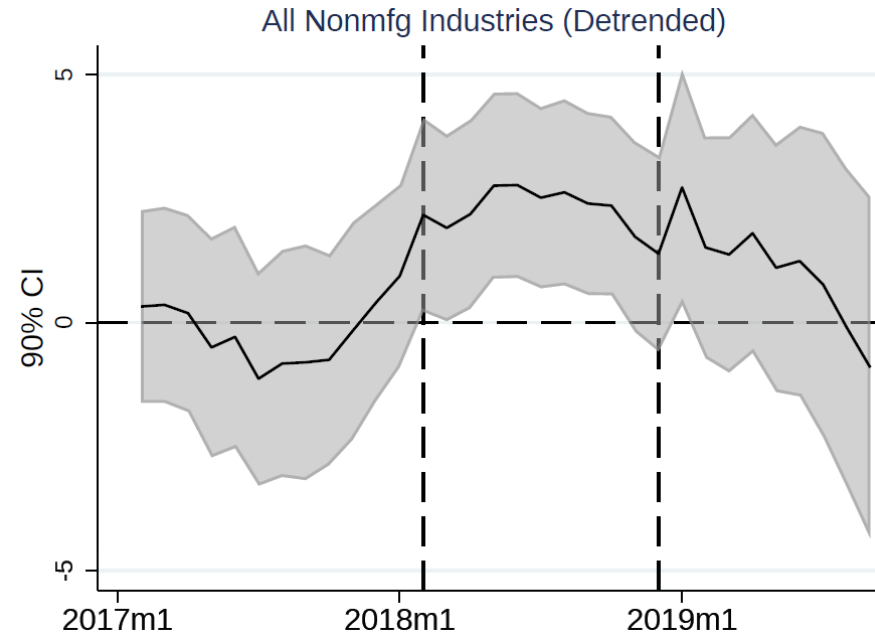
- We examine the effect of recent rounds of tariffs on U.S. manufacturing industries (employment, output, producer prices), and nonmanufacturing employment
- We allow tariffs to have effects through three channels:
 - Import protection
 - Rising input costs
 - Foreign retaliation
- We find that recent tariffs associated with:
 - Lower manufacturing employment (via lower hiring)
 - Higher producer prices
- We also find broader implications as tariffs are associated with relative increases in unemployment rates

Thanks

Effects of Tariffs on Nonmanufacturing

- Nonmanufacturing industries may also be affected by tariff changes
- We examine relationship between employment in nonmanufacturing industries and rising input cost channel
 - IP and PPI data typically not available for nonmanufacturing industries
 - Services industries are not subject to tariffs on imports/exports
- Empirical approach is identical to manufacturing sample
- Sample includes 175 nonmanufacturing industries, but they are, on average, much more aggregated than manufacturing industries

Tariffs and Nonmanufacturing Employment (Detrended)

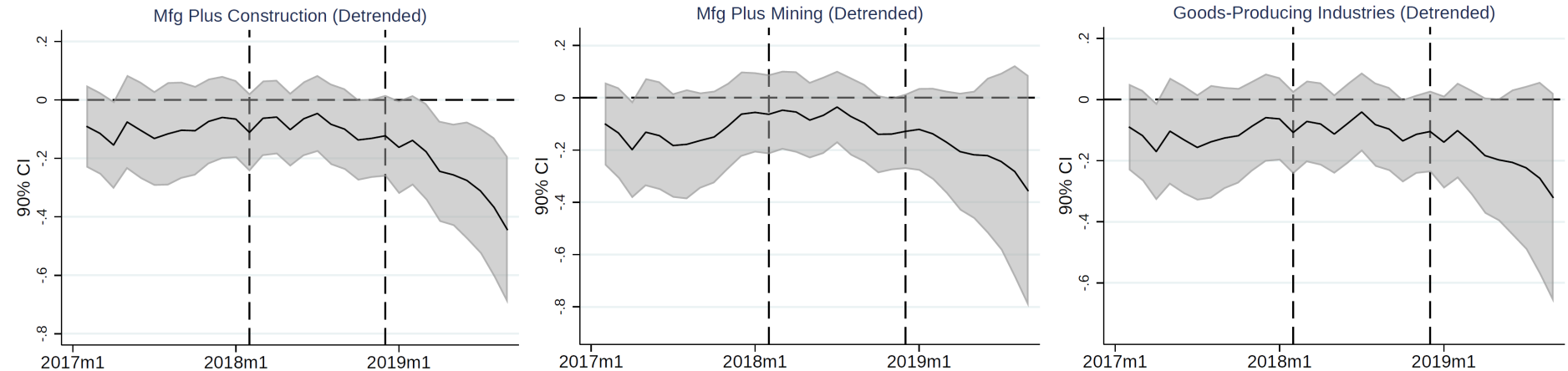


- Do not find evidence for effect of tariffs in nonmanufacturing industries
- Finkelstein test approach lacks statistical significance (p-value 0.17)

Lack of Relationship for Nonmfg. Industries is Unsurprising

- **Nonmanufacturing industries less exposed to rising input costs**, as manufactured goods make up less of their input costs
 - Average manufacturing industry is 8 times more exposed to tariffs via rising input costs than average nonmanufacturing industry
 - Top 43 industries in terms of exposure are all manufacturing
- **Short-term vs. long-term:** May take longer for effects to manifest as they have to move through more steps of the supply chain
- **Data aggregation:** As mentioned, data much more aggregated for nonmfg
 - In IO tables, all construction industries match to single NAICS code: 23
 - Nonmfg results are sensitive to inclusion of construction

Tariffs and Nonmanufacturing Employment (Detrended)



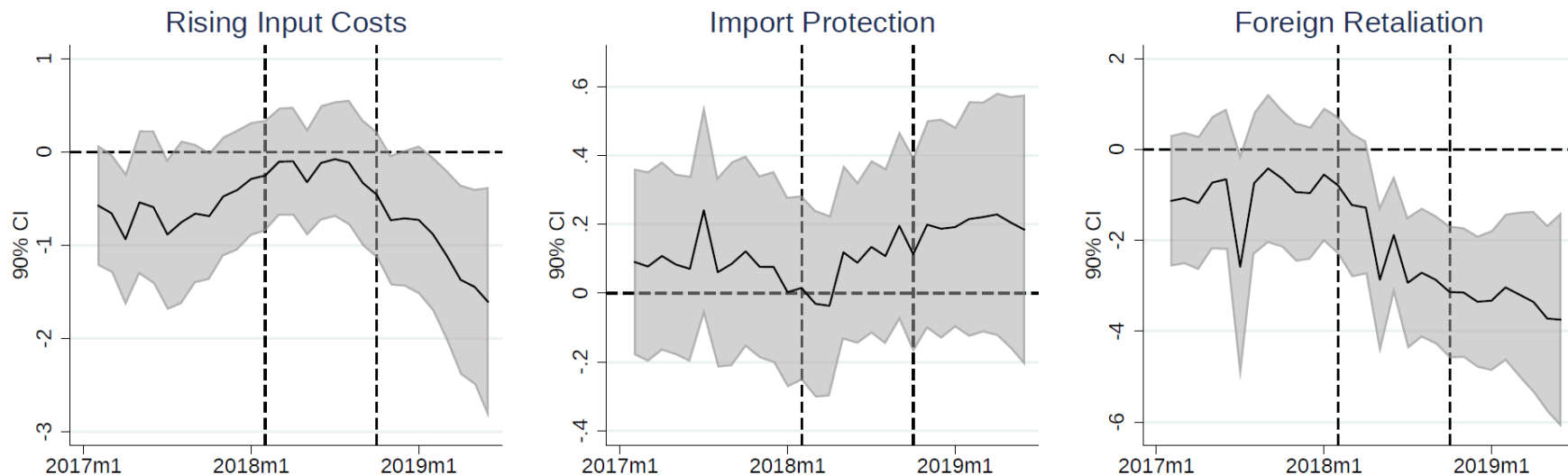
- General contour shows through to broader industry groupings, though results are not precisely estimated:
 - Mfg. plus construction
 - Mfg. plus mining
 - Goods-producing industries (NAICS 1-3)

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Trade Policy Uncertainty

- Much of discussion of effects of 2018-2019 tariffs focuses on role of uncertainty about trade policy (Caldara et al. 2019)
- Recent literature has documented substantial effects of trade policy uncertainty on economic activity (Pierce and Schott 2016; Crowley, Extton and Han 2016, Handley and Limao 2017)
- We augment main estimating equation with measure of industry-level trade policy uncertainty from Caldara et al. (2019)
 - Measures frequency of references to trade policy uncertainty in quarterly earnings calls of publicly traded firms (text analysis)
 - Defined at higher level of aggregation for industries (Fama-French 12 vs. our NAICS 4) and time (quarterly vs. our monthly)
 - Measure ends in June 2019 versus August 2019 in our baseline

Tariffs and Employment (Detrended)



- Results are robust to inclusion of measure of trade policy uncertainty
- Supports idea that tariffs associated with changes in economic activity that are distinct from effects of TPU

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