

Self-Harming Trade Policy? Protectionism and Production Networks

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Motivation

- In 2018, U.S. imposed new tariffs on $\simeq 12\%$ of imports and ensuing trade war sparked new debates on the effects of protectionism
 - Global supply chains hit heavily
- Protectionism on intermediate inputs not new
 - Since 1990s: temporary trade barriers (TTBs) restrict trade in intermediate inputs
 - TTBs: antidumping, countervailing duties, and safeguards
- Supply-chains considerations prominent in policy discussions
 - Protected industries vs sectors that use protected goods as inputs
- Scant systematic evidence

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What We Do

Estimate dynamic effects of protectionism through vertical production linkages

- 1 Identify **NAICS 4-digit trade-policy shocks** using product-level monthly data on U.S. TTBs
 - Measures “**upstream protectionism**” using NAICS 4-digit I-O tables
- 2 Estimate **employment effects** within and across industries: panel local projections
- 3 **Inspect the mechanism:**
 - Response of input and output prices in downstream industries
 - Stock market response in downstream industries (daily data)
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Results

- 1 **Protected industries:** small, short-lived, and mostly insignificant beneficial employment effects
- 2 **Downstream industries:** negative, persistent, and statistically-significant employment effects
- 3 **Mechanism:**
 - Intermediate-input and final producer prices increase prior to the employment decline: loss of competitiveness
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Data

TTB Key Institutional Features

- 1 TTBs require: (i) petition by industry producers and (ii) USITC investigation
- 2 Regulation-induced decision lags: > 1 month to open an investigation
 - Producers must gather evidence about dumped imports (representing at least 25% of the product's domestic production)
 - USITC's assessment of compliance
- 3 Opening of an investigation publicly announced, disclosing supporting evidence
 - Focus on investigation dates to avoid anticipation effects
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TTB Data

- World Bank's Temporary Trade Barriers Database:
 - Date of each TTB investigation
 - HS 6-digit products subject to investigation
- Construct monthly time series of products subject to a new investigation: NAICS 4-digit level (1994-2015)
 - 70 narrowly defined manufacturing sectors
 - Most detailed level at which employment, producer prices, and input-output data are available at a consistent level of aggregation
 - Pierce and Schott (2009)'s concordance table

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Top TTB Users: Descriptive Statistics

Top TTB Users (NAICS-4 Code)	Episodes (Products)	% Success	Median Tariff (Duration in Months)	New TTBs, Average Import Share	New TTBs, Max Import Share	2007 Sectoral Imports/Output
Iron, Steel and Ferro Alloy (3311)	60 (457)	82%	35.1% (111)	1.87%	8.89%	33.55%
Basic Chemical (3251)	44 (63)	75%	101.0% (107)	0.21%	2.26%	14.56%
Other Fabricated Metals (3329)	15 (28)	80%	57.5% (125)	1.53%	8.14%	37.04%
Steel Products From Purchased Steel (3312)	11 (33)	64%	27.9% (116)	11.09%	31.50%	8.61%
Resin, Rubber, Fibers (3252)	10 (14)	90%	24.8% (98)	1.04%	3.18%	14.56%
Spring and Wire Products (3326)	9 (11)	100%	116.3% (125)	7.23%	21.33%	36.49%
Agr., Constr., and Mining Machinery (3331)	8 (21)	88%	193.5% (115)	1.34%	4.97%	59.37%
Nonferrous Metal Production (3314)	7 (17)	86%	60.5% (102)	0.73%	2.09%	64.99%

TTBs and Production Networks (Cont.)

Top TTB Users (NAICS-4)	NAICS-4 Output Share	NAICS-4 Av. Input Share Direct Req.	NAICS-4 Max Input Share Direct Req.	NAICS-4 Av. Input Share Total Req.	NAICS-4 Max Input Share Total Req.
Iron, Steel and Ferro Alloy (3311)	1.96%	2.27%	35.70%	4.79%	44.80%
Basic Chemical (3251)	4.23%	2.15%	44.72%	8.25%	84.56%
Other Fabricated Metals (3329)	0.59%	0.66%	3.63%	1.14%	4.77%
Steel Products From Purchased Steel (3312)	0.18%	0.42%	17.68%	0.40%	19.15%
Resin, Rubber, Fibers (3252)	1.92%	1.69%	36.77%	3.16%	41.78%
Spring and Wire Products (3326)	0.43%	0.09%	6.85%	0.16%	7.38%
Arch., Constr. and Mining Machinery (3331)	1.59%	0.003%	0.255%	0.25%	1.00%
Nonferrous Metal Production (3314)	1.10%	1.00%	18.29%	3.41%	35.59%
Total	12.7%	7.96%		21.50%	

Baseline Measure of TTB Protection

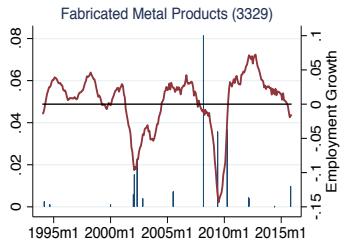
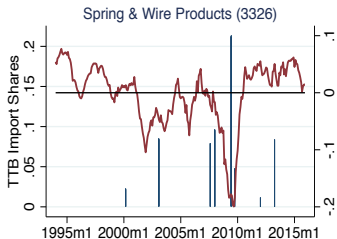
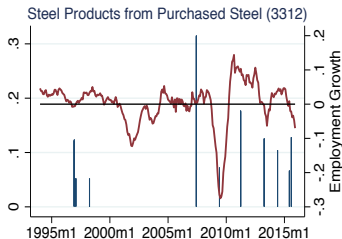
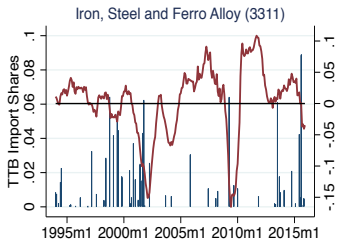
- NAICS 4-digit shares of imports subject to new TTBs in a month:

$$\tau_{it} \equiv \sum_k \sum_j \omega_{ij}^k \mathcal{I}_{ijt}^k$$

- $\mathcal{I}_{ijt}^k = 1$ if imports of product j from country k subject to a new investigation at time t
 - $\omega_{ij}^k \equiv$ average, bilateral, sector- i import share for product j from country k in the previous-year
- τ_{it} combines information on **extensive and intensive margin**
 - Single product entailing a large value of trade is more important than many products with modest trade

TTB Import Shares and Employment Growth

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Identification

Strategy

- Consolidated strategy in monetary and fiscal policy literature (e.g., Romer and Romer, *AER* 2004; Auerbach and Gorodnichenko, *AER* 2013):
 - **First stage:** purge TTBs of variation endogenous to employment (past, current, and expected) \implies conditional exogeneity.
 - **Second stage:** estimate panel local projections
- **First stage regression:** **time series** (benchmark) and **panel** (robustness)
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Time-Series Approach

- Fractional response model for each industry i

- $\tau_{it} \in (0, 1)$: restrict conditional mean

$$\tau_{it} = \frac{\exp\{\mu_{it}\}}{1 + \exp\{\mu_{it}\}} + \varepsilon_{it}$$

$$\begin{aligned} \mu_{it} \equiv & \delta_i + \sum_{\kappa=1}^{P_L} \phi_{L_i}^{\kappa} \Delta L_{it-\kappa} + \sum_{\kappa=1}^{P_{L^{DI}}} \phi_{L_i^{DI}}^{\kappa} \Delta L_{it-\kappa}^{DI} \\ & + \sum_{\kappa=1}^{P_{MB}} \phi_{MB_i}^{\kappa} MB_{it-\kappa} + \sum_{\kappa=1}^{P_{MB^{DI}}} \phi_{MB_i^{DI}}^{\kappa} MB_{it-\kappa}^{DI} + \sum_{\kappa=1}^{P_x} \alpha_{\kappa} x_{t-\kappa}, \quad (1) \end{aligned}$$

- $\Delta L_{it-\kappa}$: employment growth ($\Delta L_{it-\kappa}^{DI}$ in downstream industries)
- $MB_{it-\kappa}$: median market-to-book ratio, using firm-level data ($MB_{it-\kappa}^{DI}$ in downstream industries)
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Market-to-Book Ratio

- Benchmark firm-level measure of expected returns from finance literature (Compustat/CRSP):

$$MB_{ijt} \equiv \frac{E_{ijt}}{V_{ijt}}$$

- $E_{ijt} \equiv$ equity market value for firm i (outstanding shares \times price)
 - $V_{ijt} \equiv$ accounting value (from company's balance sheet)
 - $MB_{ijt} > 1$: positive expected returns
 - $MB_{it} \equiv \text{mdn}(MB_{ijt})$
- MB_{it} contains information about petitioners' expected profitability
 - Petitioner-specific market-to-book ratio for largest TTB user:
 $\text{corr}(MB_{3311,t}, MB_{3311,t}^P) = 0.95$
- MB_{it} has forecasting power for industry employment growth (Granger causality)

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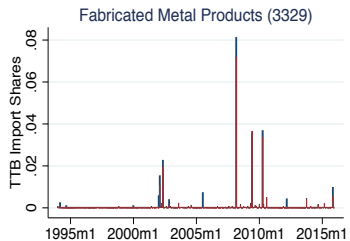
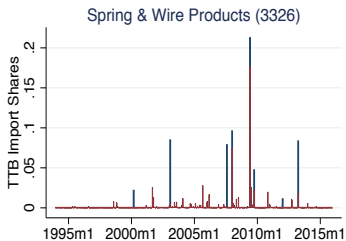
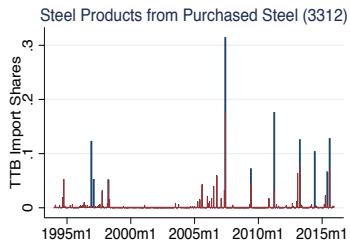
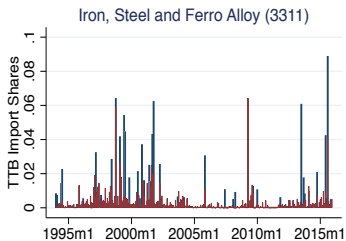
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Predicted vs Actual TTB Import Shares

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Measuring Upstream Protectionism

- Combine identified structural shocks with information from I-O matrices
- Compute exposure to upstream protectionism as **weighted average of shocks across industries**:

$$\hat{\varepsilon}_{i,t}^{IO} \equiv \sum_{j \neq i} \theta_{ij} \hat{\varepsilon}_{j,t}$$

- Fixed weights $\theta_{ij} \equiv$ contribution of industry j to output of industry i
- Total-requirements input-output table in year 2007 (both direct and indirect contributions)

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Local Projections

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- Estimate employment response using **local projections** (Jorda, 2005)
- h -step ahead predictive panel regressions:

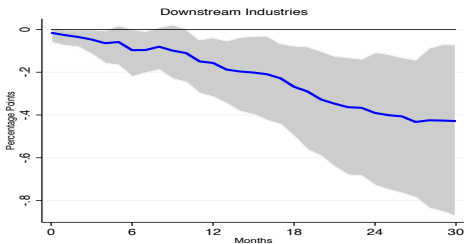
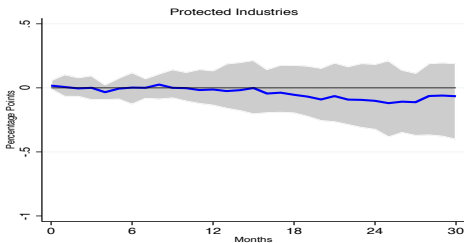
$$\Delta L_{it+h} = v_{ih} + \gamma_h \hat{\epsilon}_{it} + \psi_{t+h} + \epsilon_{it+h}$$

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- $\Delta L_{it+h} \equiv \log L_{it+h} - \log L_{it-1}$: cumulative employment difference
- v_{ih} and ψ_{t+h} : industry and time fixed effects

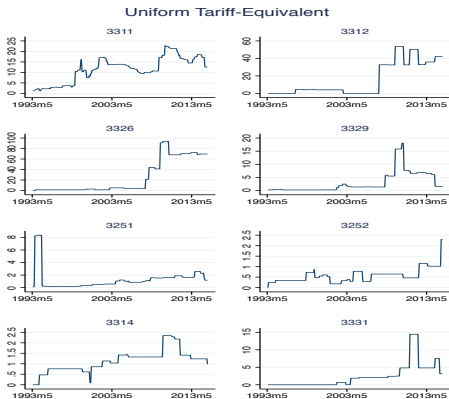
Employment Response (Time Series Identification)

- 1% increase in the share of imports subject to new TTBs



Understanding Magnitudes

- Map TTB shocks in a corresponding **sectoral uniform-tariff variation** $\bar{\tau}_{it}$



- Compute elasticity of $\bar{\tau}_{it}$ to the share of imports subject to new TTBs:

$$\Delta\tau_{it} = 1\% \implies \Delta\bar{\tau}_{it} = 1.02\%$$

Mechanisms and Quantitative Implications

Inspecting the Mechanism

- **Loss of competitiveness:** candidate explanation for downstream employment decline
 - Downstream producers cannot quickly replace inputs subject to TTBs \implies pay higher price
 - Producers switch to potentially less-efficient domestic suppliers \implies pay higher price
- Test the mechanism:
 - Response of **intermediate-input and final-producer prices in downstream industries** (also prices in protected industries)
 - Response of **downstream-industries excess stock returns** following TTB investigations (**daily data**)

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Inspecting the Mechanism (Cont.)

- Intermediate-input price index P_{it}^I :

$$P_{it}^I \equiv \sum_{j \neq i} \theta_{ij} P_{jt}$$

– $P_{jt} \equiv$ Producer Price Index (NAICS 4-digit, available from 2004)

- Median daily returns using firm-level stock price data from CRSP:

$$R_{id} = (P_{id} - P_{id-1}) / P_{id-1}$$

- Local projections:

$$\Delta P_{it+h}^I = v_{ih} + \pi_h^I \hat{\varepsilon}_{it}^{IO} + \sum_{s=1}^p \phi_{sh} \Delta P_{it-s}^I + \psi_{t+h} + \varepsilon_{it+h},$$

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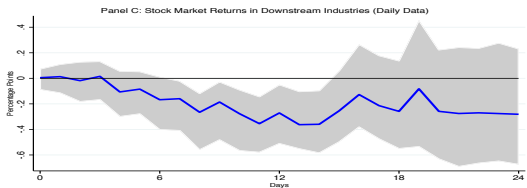
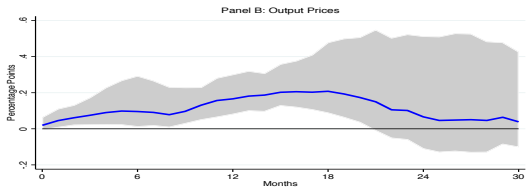
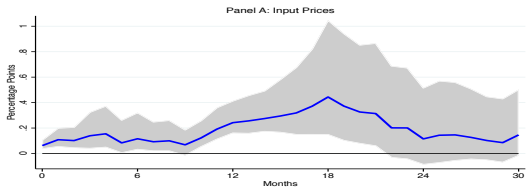
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$$\Delta R_{id+h} = v_{ih} + \rho_h^{IO} \hat{\epsilon}_{id}^{IO} + \rho_h \Delta R_{d+h}^m + \epsilon_{id+h}.$$



Aggregate Effects

- 1 **Manufacturing employment loss after 12 months**, including potential **spillovers** across industries:
 - Largest TTB episode (Steel sector, August 2015): 0.34% (0.24% without spillovers)
 - Average TTB shocks: 0.15% (0.11% without spillovers)
- 2 **Aggregate employment loss after 12 months**:
 - Largest TTB episode (Steel sector, August 2015): 0.29%
 - Average shocks in TTB episodes: 0.034%

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Conclusion

- Estimate dynamic effects of protectionism:
 - Small, short-lived, and mostly insignificant effects in protected industries
 - Long-lasting and significant negative effects in downstream industries
- Loss of competitiveness and lower profitability contribute to downstream employment losses
 - Higher intermediate-input and final producer prices
 - Decline in daily downstream-industries stock returns
- TTBs have small aggregate employment effects on average, but effects can be sizeable in large TTB episodes

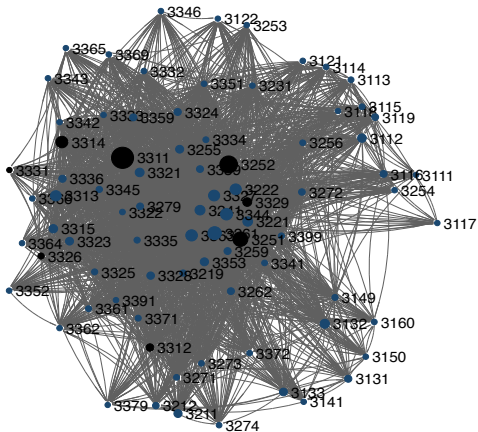
Appendix

Literature

- Effects of 2018 trade war on U.S. prices, imports, and welfare
 - Amiti Redding Weinstein (2020); Fajgelbaum, Goldberg, Kennedy, Khandelwal (2020), Flaen and Pierce (2019)
- Trade policy and vertical production linkages
 - Conconi, Garcia-Santana, Puccio and Venturini (2018); Blanchard, Bown and Johnson (2018), Bown et al (2020)
- Effects of protectionism on aggregate outcomes
 - Barattieri, Cacciatore, Ghironi (2021); Furceri. Swarnali, Ostry, and Rose (2018)
- Long-run productivity effects of trade liberalization
 - Amity and Konings (2007); Goldberg, Kumar, Pavcnik, and Topalova (2018)

TTBs and Production Networks

U.S. Production Network (2007)



Panel Approach

- Alternative strategy: exploit panel dimension of the data
 - Industry and time fixed effects
 - Remove (constant) unobserved industry heterogeneity and common shocks
- Panel regression:

$$\begin{aligned} \tau_{it} = & \alpha_i + \sum_{\kappa=1}^{P_L} \phi_L^\kappa \Delta L_{it-\kappa} + \sum_{\kappa=1}^{P_{LDI}} \phi_{LDI}^\kappa \Delta L_{it-\kappa}^{DI} \\ & + \sum_{\kappa=1}^{P_{MB}} \phi_{MB}^\kappa MB_{it-\kappa} + \sum_{\kappa=1}^{P_{MBDI}} \phi_{MBDI}^\kappa MB_{it-\kappa}^{DI} + \eta_t + \varepsilon_{it}, \end{aligned} \quad (2)$$

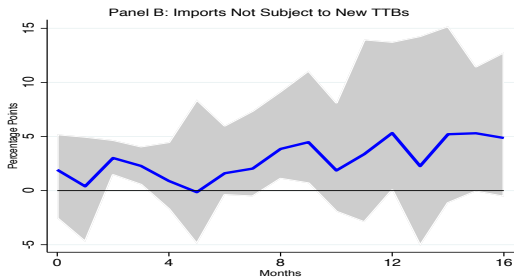
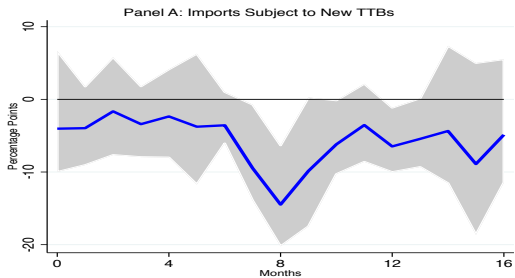
- Fixed effects (potentially) remove variation in τ_{it} unrelated to employment outcomes (which we would like to keep)

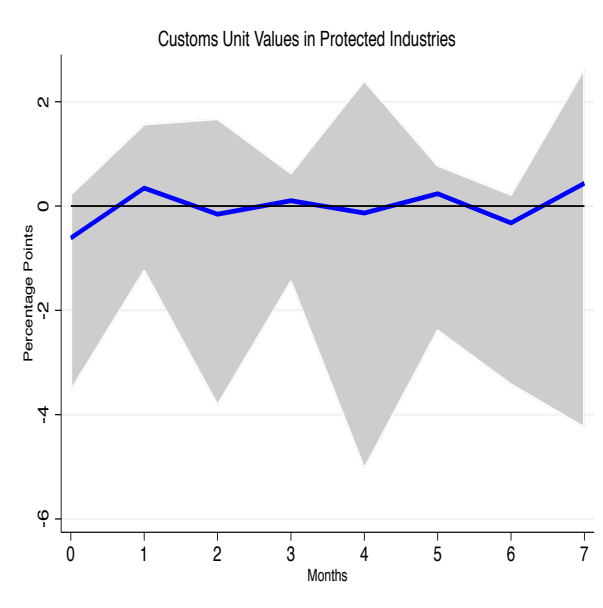
Interpreting TTB Shocks

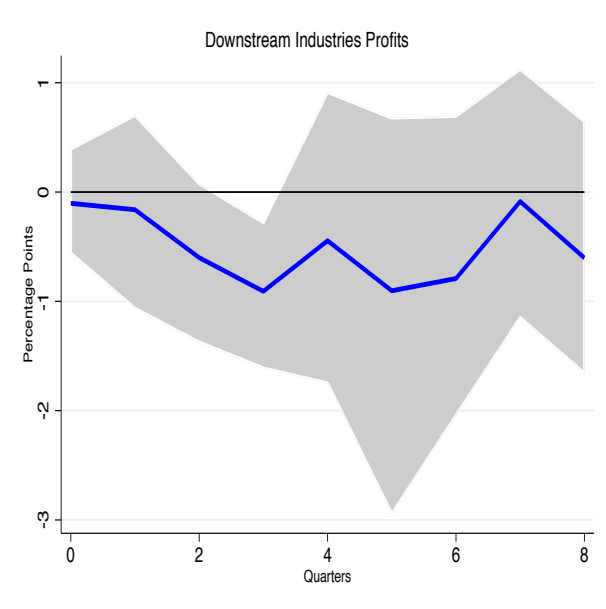
- Identified TTB shocks are conditionally exogenous to employment dynamics in protected and downstream sectors
- Trade and antitrust literature offer explanation for TTB remaining variation ($\hat{\varepsilon}_{it}$):
 - Political pressure (lobbying): affect domestic market structure and exports (“tit-for-tat” strategies)
 - Prevention of foreign predatory pricing
 - Retaliation against foreign protectionism
 - Strategies to coordinate and support collusive behavior

Robustness

- **Additional outcome variables**
 - Bilateral imports
 - Custom unit values
 - Profits (upstream and downstream industries)
- **Abnormal stock market returns**







Robustness (Cont.)

- Probit model in the first-stage ($\hat{\varepsilon}_{it}$)
 - Potential measurement error in τ_{it} due to the use of lagged imports
- Alternative measure of industry-level expectations
 - Price-to-earnings ratio
- Different upstream-protectionism measures ($\hat{\varepsilon}_{it}^{IO}$)
 - Sectoral shocks as a fraction of total imports

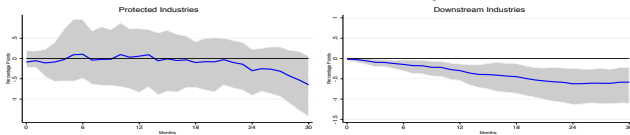
$$\hat{\varepsilon}_{it}^{IO} \equiv \sum_{j \neq i} \theta_{ij} s_j \hat{\varepsilon}_{jt},$$

where $s_j \equiv$ previous-year import share of sector j relative to total imports

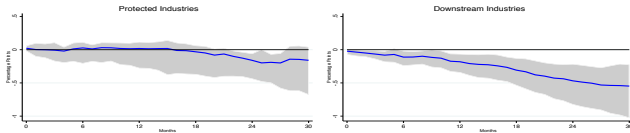
- Only successful investigations

Employment Response to Protectionism

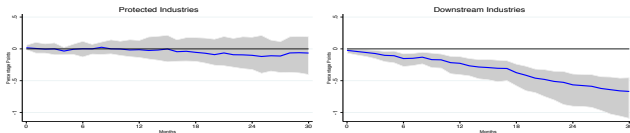
Panel A: Probit Model in the First Stage



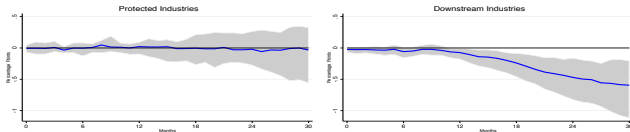
Panel B: Price-to-Earnings in the First Stage



Panel C: Upstream Protectionism Shocks using Import Weights



Panel D: Only Successful Initiatives



Robustness (Cont.)

- **Additional industry-level controls in the first-stage regression**

- Hourly earnings
- Imports
- Sales
- Industry-specific commodity prices

- **Alternative measure of protectionism:**

- Variation in TTB uniform-tariff equivalent (rather than share of imports subject to TTBs)

- **Alternative measure of upstream protectionism**

- Sectoral weights consider upstream industries' average openness:

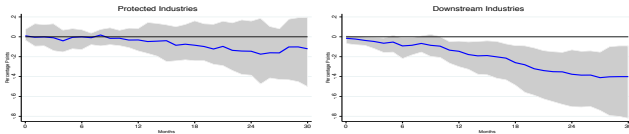
$$\hat{\varepsilon}_{it}^{IO} \equiv \sum_{j \neq i} \theta_{ij} \tilde{s}_j \hat{\varepsilon}_{jt},$$

where $\tilde{s}_j \equiv$ average share of imports relative to output

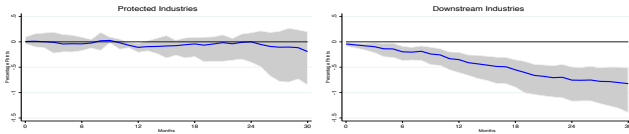
- **Include global safeguards**

Employment Response to Protectionism

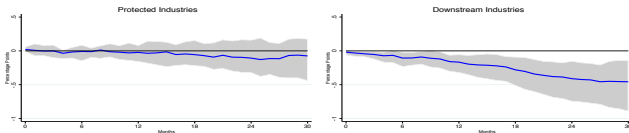
Panel A: Hourly Earnings in the First Stage



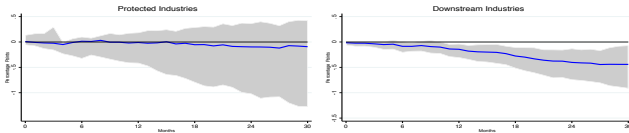
Panel B: Imports in the First Stage



Panel C: Quarterly Sales in the First Stage

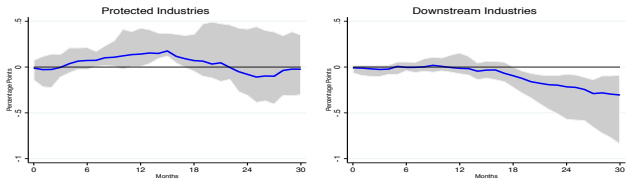


Panel D: Commodity Prices in the First Stage

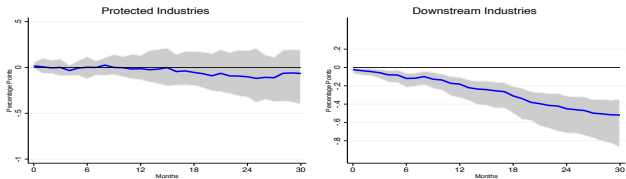


Employment Response to Protectionism

Panel A: Protectionism Measured by TTB Uniform Tariff Change



Panel B: Upstream Protectionism Shock using Import/Output Weights



Panel C: TTBs Including Global Safeguards

