Empirical Effects of Trade Policy II
Other Reduced Form Approaches

ECON 871

Introduction

We tend to want to do the following:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$$

- Where Y_{it} is some economic outcome (employment, production, etc.).
- And X_{it} is usually a change in trade policy or import competition.

Problem: Trade policy/import competition are (usually) endogenous to the state of the economy (t) and industry health (i).

- Trade barriers are raised to protect struggling industries.
- Import competition may also rise *because* domestic industry is struggling.

Today

Three Papers all with different identification strategies.

- Pierce and Schott (2016)
- Flaaen et al. (2020)
- Greenland and Lopresti (2022)

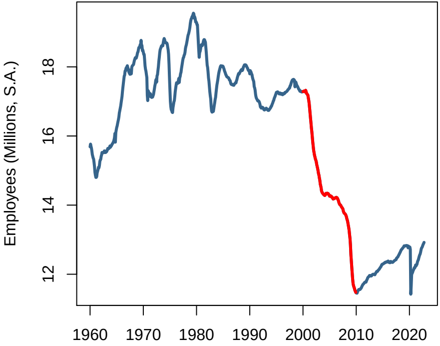
Side Note: No Trump tariff papers today, but...

- Influx of papers estimating the effects of tariffs/trade policy after the Trump Tariffs.
- Why? Off-the-shelf exogenous shock.
  - So widespread (un-targeted) and surprising, not endogenous to industry health.

Pierce & Schott (AER, 2016)

Background: One of several papers to show a link between **Chinese import competition** and the sharp **decline in U.S. manufacturing employment** starting around 2000.

Figure: U.S. Manufacturing Employment (1960-2022)



Note. Monthly data from the CES, pulled from FRED (MANEMP).

Pierce & Schott (AER, 2016)

Background:

- China had "Normal Trade Relations" (NTR) status with the U.S. since 1980.
  - Faced relatively low, MFN tariff rates (Col 1. from last class).
- NTR status was **contentious and uncertain**: had to be renewed annually by congress.
  - If *not* renewed, China would be subject to the high Column 2 rates established under Smoot-Hawley.
- In October 2000, Congress granted China "Permanent Normal Trade Relations" (PNTR) status, **eliminating need for annual renewal**.
  - PNTR status went into effect upon China's accession to the WTO in 2001.

Pierce & Schott (AER, 2016)

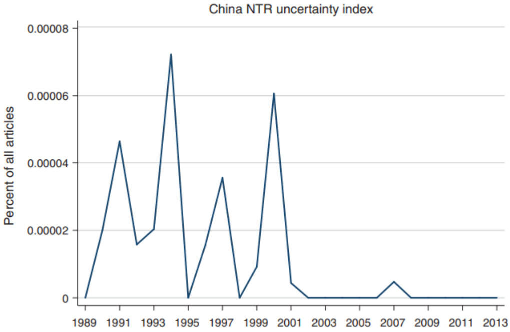


FIGURE 1. CHINA MOST FAVORED NATION (MFN) UNCERTAINTY INDEX

Note: Figure displays percent of *New York Times*, *Wall Street Journal*, and *Washington Post* articles discussing the uncertainty of China's NTR status.

Pierce & Schott (AER, 2016)

Basic Idea: This decrease in *uncertainty* about trade policy increased import competition from China. Why?

Intuition: Draws from literature on *investment under uncertainty*.

- U.S. firms more willing to incur sunk costs to shift operations to China.
- Similarly, Chinese producers more incentive to invest/enter in U.S. market.
- U.S. producers more willing to invest in capital- or skill-intensive production technologies or less labor-intensive products. (More consistent with U.S. comparative advantage.)

Pierce & Schott (AER, 2016)

Identification: Exploit variation across industries in the *degree to which uncertainty was reduced* after conferral of PNTR status.

Key Independent Variable: "NTR Gap"

$$\text{NTR GAP}_i = \text{Non-NTR Rate}_i - \text{NTR Rate}_i \tag{1}$$

- Ad valorem equivalent tariff rates from 1989-2001 (HS8).
- Concord to SIC and NAICS industries.
- NTR gap for a SIC/NAICS industry i is the average of the NTR gap across 8-digit tariff lines belonging to that industry.

Other Data: Census Longitudinal Business Database (LBD).

Nice discussion of concordance issues in Section I.B. of the paper.

Exogeneity of NTR Gap?

Potential Concern: NTR Gap correlated w/industry performance.

"Gap" variables can be tricky to work with. Two components:

$$\text{NTR GAP}_i = \underbrace{\text{Non-NTR Rate}_i}_{\text{Set in 1930.}} - \underbrace{\text{NTR Rate}_i}_{\text{Concurrent.}} \tag{2}$$

- Non-NTR Rate set in 1930 is **plausibly exogenous** simply based on timing.
  - May have been set higher in 1930 b/c of industry health, but lots changed over 70-year period since it was set.
- Potential concerns with NTR Rate should **bias results in the opposite direction**.
  - Higher NTR Rate set today to protect declining industry, should lead to *smaller* NTR gaps.

▸ Return

Pierce & Schott (AER, 2016)

Figure: Distribution of NTR Gaps Across Industries, 1999

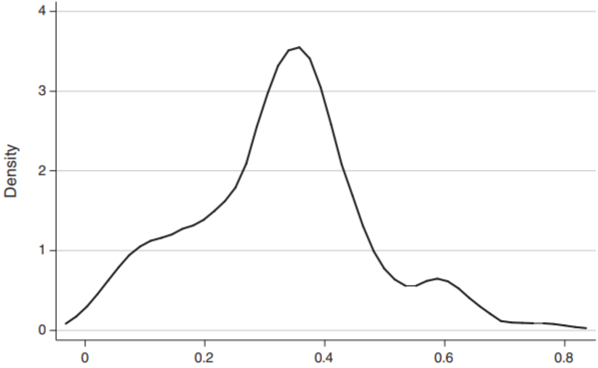


FIGURE 2. DISTRIBUTION OF NTR GAPS ACROSS CONSTANT MANUFACTURING INDUSTRIES, 1999

Pierce & Schott (AER, 2016)

Baseline Specification:

$$\ln(\text{Emp}_{it}) = \theta \text{Post-PNTR}_t \times \text{NTR Gap}_i + \text{Post PNTR}_i \times \mathbf{X}_i' \gamma$$
$$+ \mathbf{X}_{it}' \lambda + \delta_t + \delta_i + \alpha + \varepsilon_{it}$$

- Difference-in-differences type approach.
- NTR Gap_i is industry i's NTR gap in 1999 (pre-PNTR).
- Post-PNTR_t is an indicator for post-PNTR years ($t \geq 2001$).
- Variable of interest: $\theta \text{Post-PNTR}_t \times \text{NTR Gap}_i$.
- Controls:
  - Time invariant industry characteristics $\times$ Post-PNTR dummy.
  - Time-varying industry characteristics (Including NTR tariff rate.)
  - Time, industry fixed effects.

Pierce & Schott (AER, 2016)

TABLE 1—BASELINE RESULTS (*LBD*)

	$\ln(Emp_{it})$	$\ln(Emp_{it})$	$\ln(Emp_{it})$
Post × NTR Gap_i	−0.714	−0.601	−0.469
	(0.193)	(0.191)	(0.147)
Post × $\ln(K/Emp_{i,1990})$		0.037	−0.016
		(0.031)	(0.025)
Post × $\ln(NP/Emp_{i,1990})$		0.081	0.132
		(0.054)	(0.053)
Post × Contract $Intensity_i$			−0.181
			(0.112)
Post × ΔChina Import $Tariffs_i$			−0.244
			(0.140)
Post × ΔChina $Subsidies_i$			0.063
			(0.088)
Post × ΔChina $Licensing_i$			−0.238
			(0.164)
Post × 1{Advanced $Technology_i$}			−0.036
			(0.045)
MFA $Exposure_{it}$			−0.342
			(0.060)
NTR_{it}			−0.455
			(0.670)
US Union $Membership_{it}$			−0.123
			(0.203)
Observations	5,700	5,700	5,700
R^2	0.98	0.98	0.99
Fixed effects	*i,t*	*i,t*	*i,t*
Employment weighted	Yes	Yes	Yes
Implied impact of PNTR	−0.229	−0.193	−0.151

Pierce & Schott (AER, 2016)

Interpretation: With diff-in-diff coefficients, helpful to plug in some numbers.

- θ from Column 3 = -.47.
- Shifting an industry from the 25th percentile NTR gap (.23) to the 75th percentile (.40):

  $$-0.08 = -0.47 \times (.4 - .23)$$

  Increases relative employment *loss* by .08 log points.
- **Note** these are *relative changes*! With diff-in-diff, cannot say anything about aggregate effects.

Pierce & Schott (AER, 2016)

Alternative **event study** approach to capture timing more carefully:

$$\ln(Emp)_{it} = \sum_{y=1991}^{2007} (\theta_y \mathbf{1}\{y=t\} \times \text{NTR Gap}_i) + \sum_{y=1991}^{2007} (\mathbf{1}\{y=t\} \times \mathbf{X}_t' \beta_y)$$
$$+ \mathbf{X}_{it}' \lambda + \delta_t + \delta_i + \alpha + \varepsilon_{it}$$

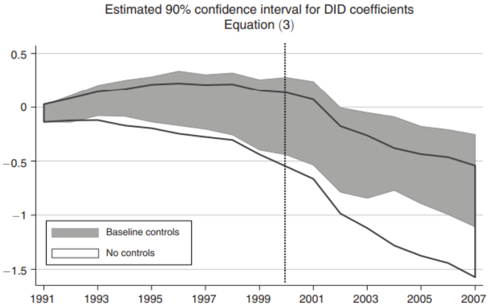


Figure 4. Estimated Timing of the PNTR Effect (*LBD*)

Flaaen et al. (AER, 2020)

Background: Long-standing question in trade with little empirical evidence: how do import tariffs affect prices?

- Are they passed on to consumers in the form of higher prices?
- Are they absorbed by foreign producers (terms of trade gains)?

Flaaen et al. (2020) use washing machines as a case study to study the effects of trade policy on:

- Trade flows.
- Domestic production.
- Prices.

Flaaen et al. (AER, 2020)

Why Washing Machines? Nice case study for several reasons:

- Subject of several trade protection measures since 2012.
  - Contrast country-specific anti-dumping duties between 2012 and 2016 with multilateral Section 201 tariffs enacted in 2018.
  - Unilateral vs multilateral action have different implications.
- Easy to classify in the trade data.
- Obvious complementarities (dryers).
- Reasonable concentration of production across a few firms.
  Allows for detailed case study of prices, production, etc.

Flaaen et al. (AER, 2020)

U.S. Washing Machine Industry (pre-2006):

- Four brands: Whirlpool, Maytag, Kenmore, GE
- 2006: Whirlpool/Maytag merger ($\sim 65\%$ mkt share).
- Imported washing machines $<$ 10 percent of U.S. sales.

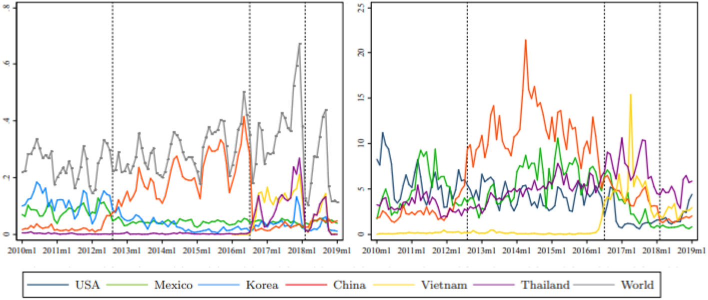
2006-2011: Samsung and LG (South Korean) expand in U.S. mkt.

- **December 2011**: Whirlpool files antidumping petition, claiming dumping of washers from Mexico and Korea.
  Imposed July 2012.
- **December 2015**: LG/Samsung maneuver production around duties, so Whirlpool files another petition, now against China.
  Imposed February 2016.
- **May 2017:** More production maneuvering, so Whirlpool petitions for *global* safeguard investigation under Section 201.
  Imposed January 2018.

Flaaen et al. (AER, 2020)

Production Maneuvering: Can be seen using customs data on Washing Machine imports and exports (six different HS codes).

Panel A. Monthly U.S. Imports of Washing Machines by Country (Quantity in Million) **Panel B.** Monthly Korean Exports of Washing Machine Parts (Millions of U.S. Dollars)



U.S. Imports: Korea/Mexico → China → Vietnam/Thailand.
Korean Exports: U.S. → China → Vietnam/Thailand.

Flaaen et al. (AER, 2020)

Production Maneuvering: Can also see this in the Bill of Lading data (PIERS).

Import shipments by LG/Samsung into the United States.

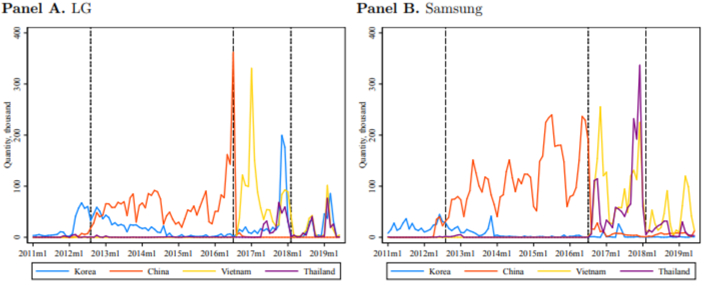


Figure 2: Firm-Level Imports of Washing Machines

Notes: See Appendix C.14 for more details.
Source: PIERS bill of lading data.

Flaaen et al. (AER, 2020)

Data: Detailed data on retail prices of major household appliances from Gap Intelligence.

Estimating Price Effects: Ideally, do an event study with prices on the LHS and look at changes after safeguard measures enacted.

Two Issues:

1. Need to filter out changes in prices due to **product characteristics**. Use Gap Intelligence data to control for tons of fixed effects, age, etc.
2. Section 232 **steel tariffs** in 2018 will increase production costs for washers around the same time. Use a control product with a similar steel cost share: **ranges (stoves)**.
   - **Idea:** Both got hit with steel tariffs, only washers got hit with 201 safegaurds. Look at prices of washers *relative* to prices of ranges.

Flaaen et al. (AER, 2020)

Baseline Regression:

$$p_{irt} = \lambda^d_{C(i)t} + \mathbf{X}_i\beta + b_{B(i)C(i)} + \sum_{a=2}^{25} \alpha^a_{C(i)} \mathbf{1}(age_{it} = a) + \gamma_r + \ell_t + \varepsilon_{irt}$$

- Ranges are the omitted product category, so all estimates are relative to the log-price of ranges before and after the event.
- $\lambda^d_{C(i)t}$ is the product category $\times$ week fixed effect.
- $\mathbf{X}_i$ is a vector of model characteristics.
  (Capacity, energy star, smart appliance, etc.)
- $b_{B(i)C(i)}$ is brand $\times$ product category fixed effect.
- age_{it} captures age of product to control for product cycle.
- γ_r is a retailer fixed effect.
- ℓ_t is a time fixed effect.

Flaaen et al. (AER, 2020)

Price Effecs of Antidumping and Safeguard Tariffs

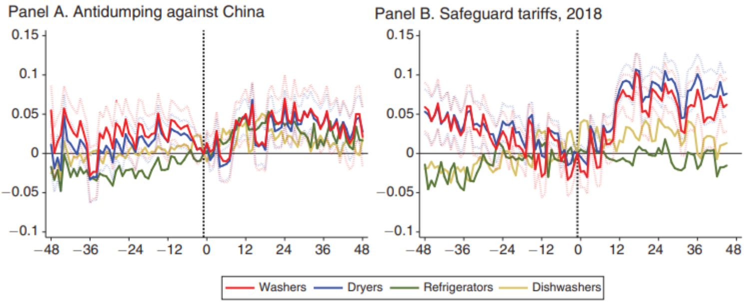


FIGURE 5. PRICE EFFECTS OF SAFEGUARD TARIFFS AND ANTIDUMPING DUTIES AGAINST CHINA

Notes: These figures report the regression coefficients $\lambda_{C(i)t}$ from equation (2). In panel A the estimates are relative to the week of July 17, 2016, and in panel B the estimates are relative to the week of January 28, 2018. The dotted lines denote 95 percent confidence intervals for the coefficient estimates for washers and dryers, based on standard errors clustered by model.

Flaaen et al. (AER, 2020)

Little bit of a pre-trend issue on the last slide, so they adjust by calculating the estimated change in prices after the introduction of import restrictions, relative the *change* in prices before the import restrictions.

$$\Delta^{4m}_{\text{event}}\,\bar{p}_C = \left(\bar{\lambda}^d_{C,\text{ -28 to -20 wks from event}} - \bar{\lambda}^d_{C,\text{-8 to 0 weeks from event}}\right) - \left(\bar{\lambda}^d_{C,\text{ -8 to 0 wks from event}} - \bar{\lambda}^d_{C,\text{+12 to 20 weeks from event}}\right)$$

They also do an analogous 8-month version.

Flaaen et al. (AER, 2020)

Punchline: Safeguard tariffs cause an 11 percent increase in the price of washing machines *and the price of dryers*!

Table 1: Difference-in-Difference Estimates: Price Effects of Washing Machine Tariffs

	Antidumping against China				Safeguard tariffs 2018			
	4-month	8-month	4-month	8-month	4-month	8-month	4-month	8-month
Washers	0.026	0.034	0.046	0.058	0.109	0.115	0.110	0.119
	(0.015)	(0.017)	(0.012)	(0.013)	(0.014)	(0.018)	(0.011)	(0.012)
Dryers	0.016	0.023	0.033	0.047	0.111	0.114	0.112	0.119
	(0.012)	(0.014)	(0.009)	(0.010)	(0.013)	(0.017)	(0.009)	(0.009)
Refrigerators	0.025	0.008	0.039	0.028	0.001	-0.035	-0.002	-0.018
	(0.010)	(0.013)	(0.007)	(0.007)	(0.010)	(0.015)	(0.006)	(0.007)
Dishwashers	0.012	-0.006	0.035	0.024	-0.010	-0.021	-0.012	-0.017
	(0.013)	(0.014)	(0.008)	(0.008)	(0.012)	(0.018)	(0.007)	(0.009)
Model characteristics	✓	✓			✓	✓		
Model fixed effects			✓	✓			✓	✓
N	1,637,298		1,637,298		1,637,298		1,637,298	

Notes: The table reports estimates for $\Delta^{4m}_{event}\bar{p}_C$ and $\Delta^{8m}_{event}\bar{p}_C$ defined in equation (3) and the text below it. The right hand side of equation (3) is a linear combination of the estimates from equation (2). Standard errors in parentheses.

Why? It turns out washers and dryers are almost always given identical prices.

Greenland & Lopresti (WP, 2022)

Goal: Identify causal effects of trade on economic outcomes—specifically, on U.S. labor markets.

Typical approach: Use large trade agreements/shocks, which happen relatively infrequently.

- Majority of literature has focused on a handful of policy shocks (e.g., China Shock, Trump Tariffs, etc.)

This Paper: New identification approach that captures changes in strength of trade barriers, without relying in large "regime change" in trade policy.

Greenland & Lopresti (WP, 2022)

This Paper: New identification approach.

Background: There are two types of tariffs:

- Ad Valorem Tariffs — tax is a percent of good's value.
  More common now.
- Specific Tariffs — tax is a dollar amount per unit.
  More common historically.

Key Idea: The strength of **specific tariffs** varies with inflation.

Simplified Example: Suppose tariff on shoes is $1 per pair.

- If shoes cost $10, equivalent tariff *rate* is 10%.
- If shoes cost $20, equivalent tariff *rate* is 5%.

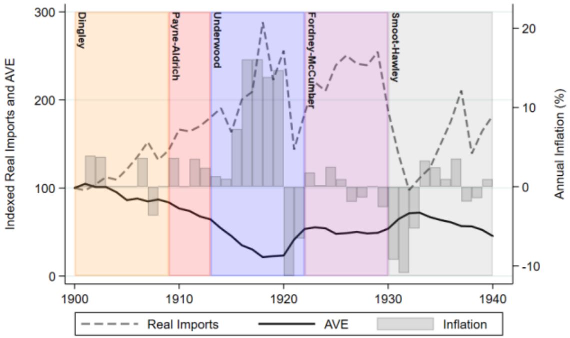
Note: When we convert specific tariffs to a rate, call it the "ad valorem equivalent" or AVE.

Greenland & Lopresti (WP, 2022)

Key Idea: The strength of specific tariffs varies with inflation.

Can exploit variation in tariff protection *within* regimes, when tariffs themselves have remained constent.

Figure 1: Real Imports, AVE, and Inflation: 1900-1940



Notes: AVE and import values from the USITC. Annual inflation reported in percent and calculated from the Jordà et al. (2017) Macrohistory Database. Real imports and AVE have been indexed to 100 in 1900. Vertical bands indicate the years encompassed by Dingley Tariff of 1897, the Payne-Aldrich Tariff of 1909, the Underwood-Simmons Tariff of 1913, the Fordney-McCumber Tariff of 1922, and the Smoot-Hawley Tariff of 1930, respectively.

Greenland & Lopresti (WP, 2022)

Fixing Ideas:
For some good, v, suppose the ad valorem equivalent tariff rate at time 0 is given by:

$$AVE_{v,t_0} \equiv \underbrace{\tau_v}_{\text{ad valorem}} + \underbrace{\frac{f_v}{p_{v,t_0}}}_{\text{specific}}$$

The share of duties on good v generated by specific tariffs, or the "specific tariff share" is:

$$STS_{v,t_0} \equiv \frac{f_v}{p_{v,t_0}\tau_v + f_v}$$

Greenland & Lopresti (WP, 2022)

Consider the relative price of a foreign variety of good v (relative to the domestic variety):

$$p = 1 + \tau_v + \frac{f_v}{p_{v,t_0}}$$

Differentiate the (log) of this relative price, noting that *within* a policy regime, $\partial \tau_v = \partial f_v = 0$:

Only have differentiate w.r.t. p_{v,t_0}.

$$\partial \ln(p) = \left(\frac{-\partial p_{v,t_0}}{p_{v,t_0}} \frac{f_v}{p_{v,t_0}} \right) \left(\frac{1}{1 + \tau_v + \frac{f_v}{p_{v,t_0}}} \right)$$

$$\approx -\underbrace{\Delta \ln(p_{v,t})}_{\text{inflation}} \times \underbrace{STS_{v,t_0}}_{\text{specific tariff share}} \times \left(\frac{AVE_{v,t_0}}{1 + AVE_{v,t_0}} \right)$$

▸ Details

Greenland & Lopresti (WP, 2022)

Key Variable measures changes in "realized protection":

$$\Delta RP_{vt} \equiv -\Delta \ln(p_{vt}) \times STS_{v,t_0}$$

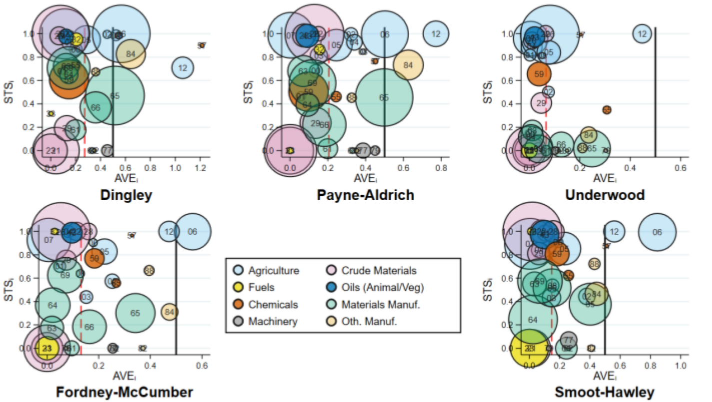
Omit the AVE term because potentially endogenous.

Data: newly digitized data on U.S. tariffs and trade flows between 1900 and 1940.

- Manually concord each tariff line to its two-digit Standard International Trade Classification (SITC) Revison 2 industry.
- Two sources of variation:
  - Cross-sectional variation in the share of specific tariffs protecting each industry (the STS_v's).
  - Time-series variation in inflation.

Greenland & Lopresti (WP, 2022)

Figure 2: Industry level STS_i versus AVE_i by Policy Regime



Notes: Figure displays specific tariff share (STS_i) versus the ad valorem equivalent (AVE_i) for each trade policy regime. Industries are two-digit Rev. 2 SITC industries. Marker size is proportional to share of start of period imports. Solid vertical lines indicate a 50% ad valorem equivalent tariff while dashed lines indicate policy-level ad valorem equivalent tariff.

Greenland & Lopresti (WP, 2022)

First Stage: Do changes in realized protection, ΔRP_{it}, cause changes in import growth?

$$\Delta \ln(m_{it}^{US}) = \beta_0 + \beta_1 \Delta RP_{it} + \Gamma X_{i,t_0} + \eta_t + \varepsilon_{it}$$

Table 3: Baseline Analysis of US Import Growth and ΔRP_{it}^{US}

	$\Delta Ln\left(Imports_{it}^{US}\right)$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ΔRP_{it}	-0.766	-0.809	-0.799	-0.427	-0.446	-0.457	-0.454
	(0.374)	(0.360)	(0.353)	(0.192)	(0.194)	(0.205)	(0.242)
AVE_{it_0}		-0.060	-0.060		-0.060	-0.064	-0.064
		(0.028)	(0.029)		(0.028)	(0.028)	(0.028)
STS_{it_0}			0.002			0.018	0.018
			(0.015)			(0.017)	(0.017)
$\Delta Ln(P_{it})$							0.003
							(0.166)
Standardized Coeff.	-.313	-.331	-.327	-.284	-.297	-.304	-.302
R^2	0.259	0.277	0.271	0.264	0.282	0.284	0.278
Obs.	135	135	135	135	135	135	135
Price Growth	UK_t^{CPI}	UK_t^{CPI}	UK_t^{CPI}	UK_{it}^{UV}	UK_{it}^{UV}	UK_{it}^{UV}	UK_{it}^{UV}
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighted	Equal	Equal	Equal	Equal	Equal	Equal	Equal
Δt	10-year	10-year	10-year	10-year	10-year	10-year	10-year
Period	1900-40	1900-40	1900-40	1900-40	1900-40	1900-40	1900-40

Notes: Dependent variable is annualized log change in US industry imports constructed from 10-year changes. ΔRP_{it} is change in realized protection which is the US industry specific tariff share multiplied by the negative price growth. Measures of price growth used in constructing ΔRP_{it} are indicated in the footer of the table: columns 1-3 employ UK CPI, while columns 4-7 use UK industry import unit values. Standard errors are clustered at two-digit SITC level and reported in parentheses.

Greenland & Lopresti (WP, 2022)

Second Stage: Estimate the local effects of import exposure.

They create county-level measures of import exposure and realized protection—a shift-share type instrument. See paper for details.

$$\Delta Y_{c,t} = \beta_0 + \beta_1 \Delta \ln(\hat{m_{c,t}}) + \beta_2 X_{c,t} + \gamma_t + \varepsilon_{c,t}$$

Where $\Delta \hat{m_{c,t}}$ is the change in imports, instrumented with $\Delta RP_{c,t}$.

Punchline: Increased import exposure leads to...

- Reduced labor force participation.
- Slows manufacturing employment growth.
- Increases growth in agriculture and services.

References I

Flaaen, Aaron, Ali Hortaçsu, and Felix Tintelnot, "The production relocation and price effects of US trade policy: the case of washing machines," *American Economic Review*, 2020, *110* (7), 2103–27.

Greenland, Andrew and John Lopresti, "Trade Policy as an Exogenous Shock: Focusing on the Specifics," *Available at SSRN 3869026*, 2022.

Pierce, Justin R and Peter K Schott, "The surprisingly swift decline of US manufacturing employment," *American Economic Review*, 2016, *106* (7), 1632–62.

Let $p = 1 + \tau_v + \frac{f_v}{p_{v,t_0}}$. Then, differentiate $\ln(p)$ w.r.t. p_{v,t_0}:

$$\partial \ln(p) = \underbrace{\left(\frac{-\partial p_{v,t_0}}{p_{v,t_0}} \frac{f_v}{p_{v,t_0}} \right)}_{\frac{\partial p}{\partial p_{v,t_0}} \partial p_{v,t_0}} \times \underbrace{\left(\frac{1}{1 + \tau_v + \frac{f_v}{p_{v,t_0}}} \right)}_{\text{Derivative of } \ln(p)}$$

$$= \left(\frac{-\partial p_{v,t_0}}{p_{v,t_0}} \right) \times \frac{f_v}{p_{v,t_0}(\tau + \frac{f_v}{p_{v,t_0}})} \times \left(\frac{\tau + \frac{f_v}{p_{v,t_0}}}{1 + \tau_v + \frac{f_v}{p_{v,t_0}}} \right)$$

$$\approx -\underbrace{\Delta \ln(p_{v,t})}_{\text{inflation}} \times \underbrace{STS_{v,t_0}}_{\text{specific tariff share}} \times \left(\frac{AVE_{v,t_0}}{1 + AVE_{v,t_0}} \right)$$

▸ Return