The 2018 Trade War

ECON 871

Introduction

The recent trade war between the United States and major trading partners was unprecendented in terms of the scope and magnitude of the tariff changes.

- Tariffs with rates ranging from 10-50 percent were imposed on more than 12,000 products covering $\sim \$300$ billion in U.S. imports.
- The average legislated tariff rate on affected imports rose from 2.6 to 16.6 percent.
- In response to the tariffs imposed by the United States, many trading partners (China, the EU, Canada, Mexico, Turkey) retaliated, imposing average tariffs of around 16 percent on $\$121$ billion of U.S. exports.
- Tariffs taken as an “exogenous” shock $\rightarrow$ many new studies of the effects of protectionism.

One Shock, Many Papers

- **Effect on Prices:** Amiti, Redding and Weinstein (2019), Cavallo, Gopinath, Neiman and Tang (2019), Fajgelbaum, Goldberg, Kennedy and Khandelwal (2020)
- **Effects through Supply Chains:** Handley, Kamal and Monarch (2020), Flaaen and Pierce (2019)
- **GE Effects:** Fajgelbaum, Goldberg, Kennedy and Khandelwal (2020)
- **Other:**
  - Effects on Investment: Amiti, Kong and Weinstein (2020)
  - Effects on Voting: Blanchard, Bown and Chor (2019)

Effect on Prices

Common Finding Across Studies: The import tariffs imposed by the U.S. were fully passed through to consumers.

- No change in import prices after the tariffs are imposed.
- Surprising? Conventional theory suggests that tariffs imposed by a large economy like the U.S. would generate terms of trade gains.
- Could be short term vs long term; also differentiated vs undifferentiated.

Effect on Prices

The study with the best data is Cavallo et al. (2019), which relies on confidential micro-data from the BLS.

- Data from the International Pricing Program (IPP).
- Collected monthly by survey, and used to construct the import and export price index.
- Firm $\times$ product level, so can trace the price of an identical product over time.

Benefits:

- Can control for a lot of stuff that might matter for pricing trends.
- Can compare the pass-through to importer prices of tariffs with an equivalent size movement in the exchange rate.

Effect on Prices

Specification:

$$\Delta \ln(P^{\mathcal{I}}_{i,j,k,t}) = \delta^{\mathcal{I}}_k + \phi_C N^{\mathcal{I},\Omega} + \phi^{\mathcal{I},-\Omega}_{CN} + \sum_{l=0}^{11} \gamma^{\mathcal{I}}_{CN,l} \Delta \tau_{CN,k,t-l}$$

$$+ \sum_{l=0}^{11} \beta^{\mathcal{I},S}_l \Delta \ln(S_{j,t-l}) + \sum_{l=0}^{11} \beta^{\mathcal{I},X}_l \Delta \ln(X_{j,t-l}) + \varepsilon_{i,j,k,t}$$

- $P^{\mathcal{I}}_{i,j,k,t}$ is the ex-tariff price of item i, imported from country j in sector k at time t.
- Sectors are BLS's “primary stratum lower”—somewhere between HS4 and HS6.
- $\delta^{\mathcal{I}}_k$ is the sectoral inflation rate.
- $k \in \Omega$ are sectors affected by the tariffs, so $\phi^{\mathcal{I},\Omega}_{CN}$ and $\phi^{\mathcal{I},-\Omega}_{CN}$ allow for constant deviation from sectoral trend for affected and non-affected products.

Effect on Prices

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$$+ \sum_{l=0}^{11} \beta^{\mathcal{I},S}_l \Delta \ln(S_{j,t-l}) + \sum_{l=0}^{11} \beta^{\mathcal{I},X}_l \Delta \ln(X_{j,t-l}) + \varepsilon_{i,j,k,t}$$

- $\tau_{CN,k,t-l}$ is the additional tariff newly applied in a particular month to imports from China in sector k at time $t-l$.
- $\gamma^{\mathcal{I}}_{CN,l}$ is the estimate of tariff rate pass-through in a given month
- $S_{j,t-l}$ is the value of country j's currency in U.S. dollars at time $t-l$
- $X_{j,t-l}$ is the PPI in j at t-l.
- $\beta^{\mathcal{I},S}_l$ is an estimate of ERPT after one year.

Effect on Prices

TABLE 1—REGRESSION ANALYSIS OF CHINESE IMPORT TARIFFS USING MONTHLY DATA

		US imports			US exports			US retail
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tariffs 1 year	$\left(\sum_{l=0}^{11}\gamma_l\right)$	−0.057	0.005		−0.329	−0.259		0.035
		(0.023)	(0.025)		(0.089)	(0.089)		(0.020)
Differentiated	$\left(\sum_{l=0}^{11}\gamma_l\right)$			−0.035			−0.087	
				(0.034)			(0.096)	
Undifferentiated	$\left(\sum_{l=0}^{11}\gamma_l\right)$			−0.272			−0.383	
				(0.103)			(0.151)	
ERPT 1 year	$\left(\sum_{l=0}^{11}\beta_l^S\right)$		0.218	0.288		0.195	0.213	
			(0.023)	(0.026)		(0.018)	(0.023)	
PPI PT 1 year	$\left(\sum_{l=0}^{11}\beta_l^X\right)$		0.047	0.091		0.250	0.274	
			(0.033)	(0.037)		(0.038)	(0.045)	
Adjusted R^2		0.002	0.003	0.004	0.001	0.002	0.003	0.001
Observations		835,722	835,722	583,391	446,527	446,527	295,179	1,118,870
Sector fixed effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Fixed effects (ϕ^{Ω}_{CN}) and $(\phi^{-\Omega}_{CN})$ are included in all regressions, but we do not report the coefficients in the table because they are not economically significant in all cases. Robust standard errors shown in parentheses.

Column 2:

- No impact on prices (0.05).
- A 10 percent depreciation of the dollar associated with 2.18 percent increase in import prices.
- Differentiated (most imports) vs undifferentiated.

Effect on Prices

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Column 5:

- U.S. exporters do absorb retaliatory tariffs—a 10 percent tariff on U.S. exports reduces ex-tariff export prices by 3.3 percent.
- Half of U.S. exports are undifferentiated agricultural products.

Effect on Prices

We just saw results for prices **at the border.** What about prices for retailers and consumers?

- Data collected daily from two large U.S. retailers—data reflects basically what you could scrape from the website.
- Country of origin and description of the product.
- Have to match products with HS codes (difficult)

Main Finding:

- Little to no effect on consumer prices (Column 7).
- No evidence that retailers are spreading price increases to other products.
- Implies retailers absorbing most of the increase in their margins.

Stockpiling and Trade Diversion

Anticipatory stockpiling and trade diversion may have played a role in the lack of response in consumer prices.

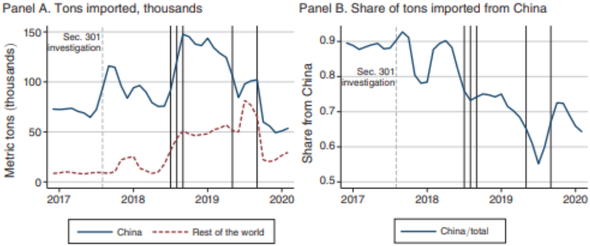


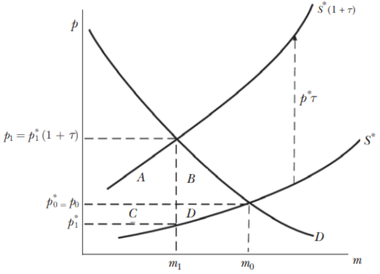
Figure 4. Front-Running and Trade Diversion by Two Major US Retailers

Notes: Figure 4, panel A, shows the total metric tons imported by two large US retailers identified in bill of lading data collected by Datamyne. The vertical lines denote the months when tariffs were introduced or increased: July 2018 (25 percent on $34 billion), August 2018 (25 percent on $16 billion), September 2018 (10 percent on $200 billion), May 2019 (increase the September 2018 wave to 25 percent), and September 2019 (15 percent on $112 billion). Figure 4, panel B, shows the share of total metric tons imported from China.

Aggregate Effects of Tariffs

Quick reminder, aggregate welfare impacts of a tariff is net change in **consumer surplus**, **producer surplus**, and **tariff revenue**.

Figure 1
Impact of a Tariff on Prices



Source: Authors.
Note: Horizontal axis shows the quantity of imports; vertical axis displays the price of the good; D corresponds to the import demand curve; S^* represents the export supply curve.

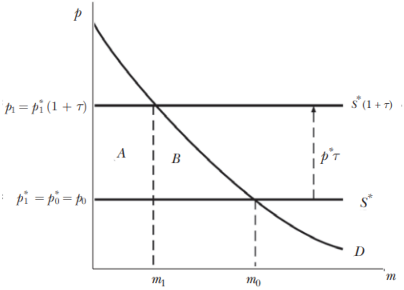
SOURCE: Amiti et al. (2019)

Consumers lose $A + B$, Government gains $A + C$.

Aggregate Effects of Tariffs

If there are no terms of trade gains (importer faces a horizontal foreign export supply curve):

Figure 2
Impact of a Tariff on Prices with Perfectly Elastic Export Supply



Source: Authors.
Note: Horizontal axis shows the quantity of imports; vertical axis displays the price of the good; *D* corresponds to the import demand curve; S^* represents the export supply curve.

SOURCE: Amiti et al. (2019)

Consumers lose $(A + B)$, government gains A.

Aggregate Effects of the 2018 Trade War

Amiti et al. (2019) does a back-of-the-envelope calculation to estimate aggregate welfare impacts. If we assume region B is a triangle, we can estimate its area:

$$\text{Area } B = \frac{1}{2} \times \text{Base } \times \text{Height}$$

- Base = $(m_0 - m_1)$ — use regression coefficients to estimate change in imports due to the tariffs.

$$\Delta \ln(m_{ijt}) = \beta_0 + \beta_1 \Delta \ln(1 + \tau_{ijt}) + \delta_i + \delta_{jt} + \varepsilon_{ijt}$$

- Height = $\tau_{ijt} p^*_{ijt}$— observable in the data.
- Estimated Welfare Impact: $-\$8.2$ billion per year.

Fajgelbaum et al. (2020) Overview

The paper by Fajgelbaum et al. (2020) is a nice mix of empirics and a structural model.

Two main questions:

- What were the effects of the tariffs on trade volumes and prices?
  - Use the tariff shock to identify U.S. import demand and foreign export supply elasticities.
- What were the aggregate and regional impacts?
  - Use the estimated elasticities from above in a GE model to compute the welfare effects of the trade war.

Fajgelbaum et al. (2020) Event Study

Basic Idea: If we believe the varieties targeted by tariffs were selected (as good as) randomly, can compare trends of targeted varieties relative to untargeted vareities:

$$\ln y_{igt} = \alpha_{ig} + \alpha_{it} + \sum_{j=-6}^{6} \beta_{0j} I(event_{igt} = j) + \sum_{j=-6}^{6} \beta_{1,j} I(event_{igt} = j) \times target_{ig} + \varepsilon_{igt}$$

- Variety (α_{ig}), country-time (α_{it}), and product-month (α_{gt}) fixed effects.
- $target_{ig}$ dummy indicates variety targeted by tariffs.
- β_{1j} identifies effect of tariffs

Fajgelbaum et al. (2020) Event Study

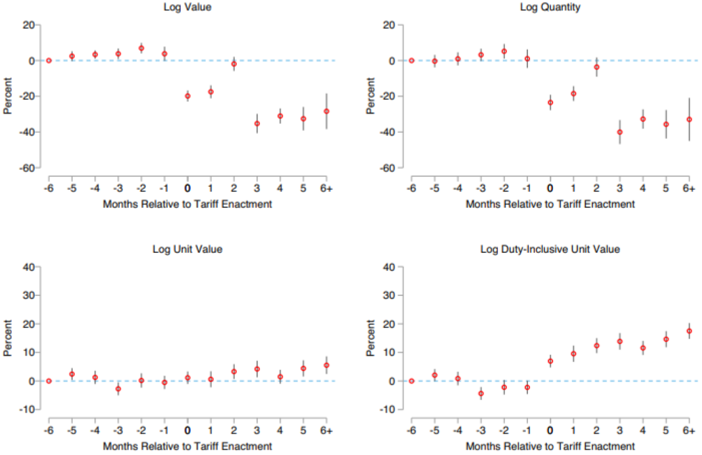


FIGURE II

Variety Event Study: Imports

Fajgelbaum et al. (2020) Elasticities

Quantitative model needs estimates of several elasticities. Most important:

- U.S. import demand elasticity, σ
- Foreign export supply elasticity, ω^*

Modeling U.S. Import Demand:

- S traded sectors (4-digit NAICS)
- Within each traded sector, demand characterized by a three-tier nested CES:
  - Upper nest: domestic vs imported goods.
  - Within each of these two nests of sector s, there are G_s products (HS10).
  - Within the nest of imported products, varieties are differentiated by country of origin, i.

Fajgelbaum et al. (2020) Elasticities

U.S. import demand (value of imports) in sector s is given by:

$$P_{Ms}M_s = E_s A_{Ms} \left(\frac{P_{Ms}}{P_s}\right)^{1-\kappa}$$

- E_s are aggregate U.S. expenditures in sector s from both consumers and firms
- A_{Ms} is an import demand shock.
- P_{Ms} is the import price index
- P_s is the sector price index.
- κ is the elasticity of demand between imports and domestic products within a sector.

Fajgelbaum et al. (2020) Elasticities

The value of imports for *product* g in sector s is:

$$p_{Mg}m_g = P_{Ms}M_s a_{Mg}\left(\frac{p_{Mg}}{P_{Ms}}\right)^{1-\eta}$$

- a_{Mg} is an import demand shock.
- p_{Mg} is the import price index of product g.
- η is the elasticity of demand across products.

Fajgelbaum et al. (2020) Elasticities

Quantity imported of product g's variety from country i is:

$$m_{ig} = m_g a_{ig} \left(\frac{p_{ig}}{p_{Mg}} \right)^{-\sigma}$$

- p_{ig} is the domestic price of the imported variety ig:

$$p_{ig} = (1 + \tau_{ig}) p^*_{ig}$$

- σ is the elasticity across imported varieties within product.

Fajgelbaum et al. (2020) Elasticities

Trade partners are represented with export-supply and import-demand curves at the variety level.

Allow for import price effects of U.S. trade policy (terms of trade effects) through potentially upward sloping foreign export supply:

$$p_{ig}^* = z_{ig}^* m_{ig}^{\omega^*}$$

- z_{ig}^* is a marginal cost shifter that could also include a bilateral iceberg trade cost.
- ω^* is the inverse foreign export supply elasticity—drives the magnitude of the reduction in foreign prices when tariffs are imposed. Larger TOT effects if ω^* is higher.

Fajgelbaum et al. (2020) Elasticities

Foreign import demand for U.S. exports of good g is:

$$x_{ig} = a^*_{ig} \left((1 + \tau^*_{ig}) p^X_{ig} \right)^{-\sigma^*}$$

- x_{ig} are U.S. exports of product g to country i.
- p^X_{ig} is the export price recieved by exporters.
- τ^*_{ig} is the tariff set by country i on U.S. exports of g
- a^*_{ig} is a foreign demand shock.

Fajgelbaum et al. (2020) Identification Strategy

To identify σ and ω^*, use variation in U.S. import tariffs to estimate both elasticities simultaneously.

- Strategy of identifying two elasticities with one instrument used in Romalis (2007) in trade, Zoutman, Gavrilova, and Hopeland (2018) in public finance.

Intuition: Tariffs create wedge between what the importer pays and exporter receives.

- Tariffs shift down demand curve for any given price received by the exporter, tracing the export supply curve.
- Tariff shifts up the supply curve for any given price paid by the consumer, tracing the import demand curve.

Fajgelbaum et al. (2020) Identification Strategy

Take log differences of import demand equation and export supply equation:

$$\Delta \ln m_{igt} = \eta^m_{gt} + \eta^m_{it} + \eta^m_{is} - \sigma \Delta \ln p_{igt} + \varepsilon^m_{igt}$$
$$\Delta \ln p^*_{igt} = \eta^{p^*}_{gt} + \eta^{p^*}_{it} + \eta^{p^*}_{is} + \omega^* \Delta \ln m_{igt} + \varepsilon^{p^*}_{igt}$$

- $y = \{p^*, m\}$, the η^y_{gt} are product-time fixed effects
- η^y_{it} are country-time fixed effects
- η^y_{is} are country-sector fixed effects.

As long as tariffs are uncorrelated with unobserved import demand and export supply shocks, both elasticities will be identified by instrumenting Δp_{igt} and Δm_{igt}, respectively, with $\Delta \tau_{igt}$.

Fajgelbaum et al. (2020) Results

TABLE IV

VARIETY IMPORT DEMAND (σ) AND FOREIGN EXPORT SUPPLY (ω^*)

	$\Delta \ln p^*_{igt} m_{igt}$ (1)	$\Delta \ln m_{igt}$ (2)	$\Delta \ln p^*_{igt}$ (3)	$\Delta \ln p_{igt}$ (4)	$\Delta \ln p^*_{igt}$ (5)	$\Delta \ln m_{igt}$ (6)
$\Delta \ln(1 + \tau_{igt})$	-1.52^{***}	-1.47^{***}	0.00	0.58^{***}		
	(0.18)	(0.24)	(0.08)	(0.13)		
$\Delta \ln m_{igt}$					−0.00	
					(0.05)	
$\Delta \ln p_{igt}$						-2.53^{***}
						(0.26)
Product × time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × sector FE	Yes	Yes	Yes	Yes	Yes	Yes
1st-stage F					36.5	21.2
Bootstrap CI					[−0.14,0.10]	[1.75,3.02]
R^2	0.13	0.13	0.11	0.11	0.00	—
N	2,993,288	2,454,023	2,454,023	2,454,023	2,454,023	2,454,023

Notes. Table reports the variety-level import responses to import tariffs. Columns (1)–(4) report import values, quantities, before-duty unit values, and duty-inclusive unit values regressed on the statutory tariff rate. Column (5) reports the foreign export supply curve IV regression, $\hat{\omega}^*$, from equation (9); the first stage is column (2). Column (6) reports the import demand curve IV regression, $\hat{\sigma}$, from equation (8); the first stage is column (4). All regressions include product-time, country-time, and country-sector fixed effects. The coefficient in column (4) is not 1 plus the coefficient in column (3) because the duty inclusive unit value is constructed using actual duties collected by U.S. customs data. Standard errors are clustered by country and HS-8. 90% bootstrap confidence intervals are constructed from 1,000 samples. Significance: * 0.10, ** 0.05, *** 0.01. Sample: monthly variety-level import data from 2017:1 to 2019:4.

Fajgelbaum et al. (2020) Results

- **Columns 1 and 2**: Cols 1 and 2 show import value and quantities drop sharply with the tariffs.
  Implies little change in import prices.
- **Column 3**: No effect on ex-tariff import unit values.
  Consistent with complete pass-through.
- **Column 4**: First stage of the IV.
- **Column 5**: $\omega^* = 0$ Can't reject horizontal export supply.
- **Column 6**: $\sigma = -2.53$

Fajgelbaum et al. (2020) Other Elasticities

Aggregate tariffs to product and sector level to estimate the elasticities on the upper nests.
See paper for details.

- Elasticity across imported HS10 products:
  $\hat{\eta} = 1.53$.
- Elasticity between imports and domestic in 4-digit NAICS:
  $\hat{\kappa} = 1.19$
- Foreign demand elasticity for variety level *exports*:
  $\hat{\sigma^*} = 1.04$

Fajgelbaum et al. (2020) Estimation

For elasticities to be identified, tariff changes must be uncorrelated with import demand and export supply shocks.

Fajgelbaum et al. (2020) address this threat to identification by showing there are no apparent pre-trends. This means varieties targeted by the tariffs were not on different trajectories pre- trade war.

$$\Delta \ln y_{ig,2017} = \alpha_g + \alpha_{is} + \beta \Delta \ln(1 + \tau_{ig}) + \varepsilon_{ig}$$

- y_{ig} are nominal imports, import quantities, import prices. Same for exports.
- No statistically significant relationship between import/export/price growth in 2017 and tariff rates ultimately applied.

Fajgelbaum et al. (2020) GE Structure

They then write down a static GE model of the United States with the following features: Details

- **Neoclassical Model:**
  - Static
  - Flexible prices
  - No labor mobility
- **U.S. Demand**
  - Cobb-Douglas over 88 traded sectors, 1 non-traded sector.
  - CES within sector (elasticities as estimated before).
- **U.S. Supply**
  - Cobb-Douglas in labor and capital (fixed) and intermediate inputs (adjustable).
- United States is divided into R counties with L_r workers in each region.
- Calibrate the model using estimated elasticities, data from the 2016 County Business Patterns, IO Tables, and trade data.

Fajgelbaum et al. (2020) Aggregate Impacts

Can use the model to quantify the aggregate impacts of the tariff war.

Basic Idea:

- For each primary factor (capital and labor), the equivalent variation is the change in income at initial prices that would have left the factor indifferent with the changes in tariffs that took place.
- Adding up the equivalent variations across all primary factors, get aggregate equivalent variation, or the change in aggregate real income.

From Dixit and Norman (1980), the term can be written as

$$EV = \underbrace{-\mathbf{m}'\Delta\mathbf{p}^M}_{EV^M} + \underbrace{\mathbf{x}\Delta\mathbf{p}^X}_{EV^X} + \Delta R$$

Fajgelbaum et al. (2020) Aggregate Impacts

$$EV = \underbrace{-\mathbf{m}'\Delta\mathbf{p}^M}_{EV^M} + \underbrace{\mathbf{x}\Delta\mathbf{p}^X}_{EV^X} + \Delta R$$

- $\mathbf{m}$ is a column vector with the imported quantities of each variety before the war. (observed)
- $\mathbf{x}$ is a column vector with exported quantities to each destination. (observed)
- $\mathbf{p}^M$ and $\mathbf{p}^M$ are changes in duty-inclusive import and export prices. (model)
- EV^M is the increase in the duty-inclusive cost of the prewar import basket.
- EV^X is the increase in the value of the prewar export basket.
- ΔR is the change in tariff revenue.

Fajgelbaum et al. (2020) Aggregate Impacts

The model is log-linearized around an initial steady state with zero tariffs. All we need are $\hat{p}_{ig}$ and $\hat{p}_{ig}^{X}$.

Since $\omega^* \approx 0$:

$$\hat{p}_{ig} \approx \frac{d\tau_{ig}}{1+\tau_{ig}}$$

Export prices are a bit more complicated—see paper appendix for details.

Fajgelbaum et al. (2020) Aggregate Impacts

TABLE VIII

AGGREGATE IMPACTS

	EV^M (1)	EV^X (2)	ΔR (3)	EV (4)
2018 trade war				
Change ($ b)	−51.0	9.4	34.3	−7.2
	[−54.8,−47.2]	[4.1,15.6]	[32.3,36.1]	[−14.4,0.8]
Change (% GDP)	−0.27	0.05	0.18	−0.04
	[−0.29,−0.25]	[0.02,0.08]	[0.17,0.19]	[−0.08,0.00]
2018 U.S. tariffs and no retaliation				
Change ($ b)	−50.9	16.6	34.8	0.5
	[−52.9,−49.0]	[13.2,20.3]	[32.8,36.5]	[−4.0,5.7]
Change (% GDP)	−0.27	0.09	0.19	0.00
	[−0.28,−0.26]	[0.07,0.11]	[0.18,0.20]	[−0.02,0.03]

Notes. Table reports the aggregate impacts in column (4) and the decomposition into EV^M, EV^X, and tariff revenue (ΔR) in columns (1)–(3). The top panel reports the effects from the 2018 trade war. The bottom panel simulates a hypothetical scenario where trade partners do not retaliate against U.S. tariffs. The first row in each panel reports the overall impacts of each term in billions of US$. The third row scales by 2016 GDP. These numbers are computed using the model described in Section V with $\{\hat{\sigma} = 2.53, \hat{\eta} = 1.53, \hat{\kappa} = 1.19, \hat{\omega}^* = -0.00, \hat{\sigma}^* = 1.04\}$. Bootstrapped 90% confidence intervals based on 1,000 simulations of the estimated parameters are reported in brackets.

Fajgelbaum et al. (2020) Aggregate Impacts

Model-based calculation matches up with simple back of the envelope calculations:

Given complete tariff pass-through, the **first-order approx. to the impact on consumer surplus** is a loss of:

$$\frac{\text{Imports}}{\text{Value Added}} \times \frac{\text{Targeted Imports}}{\text{Imports}} \times \text{Avg Price Increase if Targeted}$$

or

$$15\% \times 13\% \times 14\% = 0.27\% \text{ of GDP or } \$50.8 \text{ billion}$$

Compare to $EV^M = -\$51$ Billion or -0.27 percent of GDP.

Fajgelbaum et al. (2020) Aggregate Impacts

Under some (strong) assumptions, we can also use the elasticities to compute the impact on **aggregate real income**.

In the absence of changes in U.S. import and export prices, starting from free trade, and assuming perfect competition, the **(second-order) approximation to the aggregate EV**[1] is:

$$\frac{1}{2}(\Delta \mathbf{m})'\Delta\tau$$

In earlier notation:

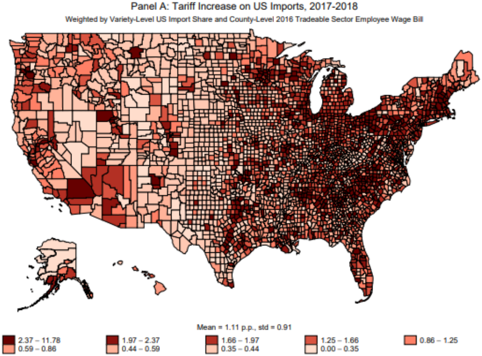
$$\frac{1}{2}\sum_{s}\sum_{g\in\mathcal{G}_s}\sum_{i} p^*_{gi} m_{gi}\Delta\ln m_{gi}\Delta\tau_{gi} = -\$11 \text{ billion or 0.06\% of GDP}$$

Where $\Delta\ln m_{gi} = -\hat{\sigma}\Delta\ln(1+\tau_{gi})$. Compare to $EV = -7.2$ billion or 0.04 % of GDP.

[1] Baqaee and Farhi (2019) show that under these assumptions, this is also the effect on real GDP.

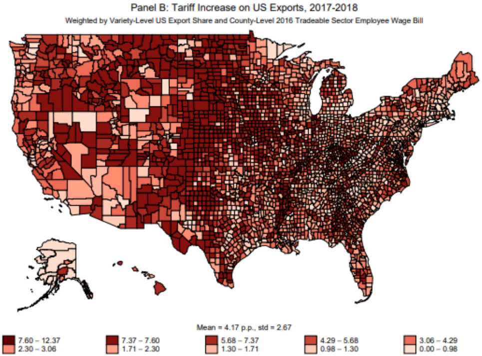
Fajgelbaum et al. (2020) Regional Impacts

Tariffs were chosen to target swing states.



Fajgelbaum et al. (2020) Regional Impacts

Retaliatory tariffs were also chosen strategically by foreign countries.



Fajgelbaum et al. (2020) Regional Impacts

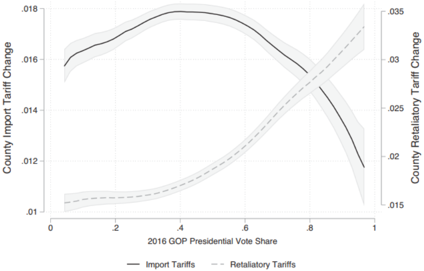


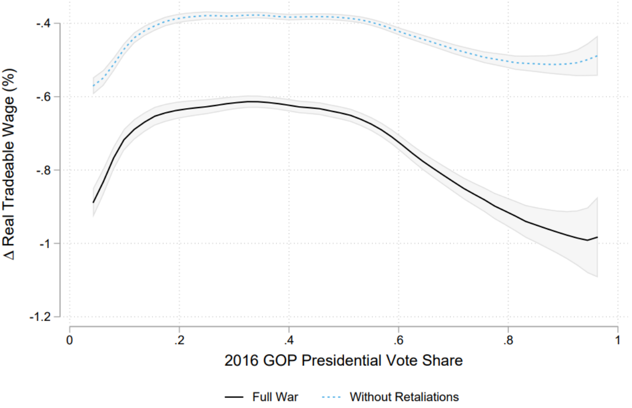
FIGURE VII

Tariff Changes versus 2016 Republican Vote Share

Figure plots county-level import and retaliatory tariff changes against the 2016 Republican presidential two-party vote share, using a nonparametric fit weighted by county population. County-level tariff changes weighted by variety-level 2013–17 U.S. trade shares and by 2016 county-level tradeable sector employee wage bill. Vote shares constructed from Federal Election Commission data. The unit of analysis is 3,111 U.S. counties.

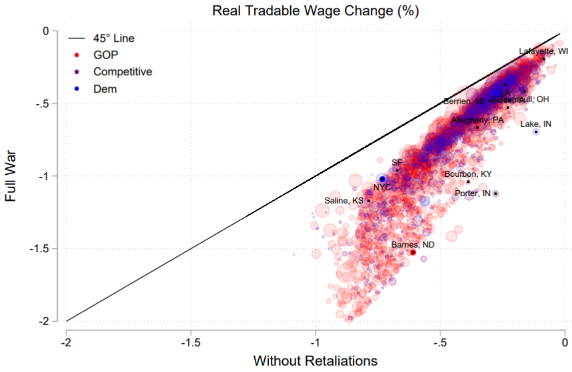
Fajgelbaum et al. (2020) Regional Impacts

Overall, real wages fell as very slight increases in nominal wages were offset by larger increases in prices.



Fajgelbaum et al. (2020) Regional Impacts

Retaliation made things much worse for republican counties.



Summary of Fajgelbaum et al. (2020)

The main findings are as follows:

1. **Substantial impact on trade flows.**
   - Large decline in imports.
   - Large decline in exports. (Retaliation.)
2. **No terms of trade gains.**
   - Tariffs fully passed through to import prices.
3. **Small aggregate effects, but large consumer losses.**
4. **Strategic Protection**
   - Higher protection in swing states.
   - Republican counties targeted by retaliation.

Caveats:

- Import prices, not retail prices.
- Does not allow for wage effects in foreign countries.
- Short run, not long-run.
- Does not account for effects of uncertainty.

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Fajgelbaum et al. (2020) GE Structure Details

Consumption in country r results from maximizing aggregte utility:

$$\beta_{NT} \ln C_{NT,r} + \sum_{s \in S} \beta_s \ln C_{sr}$$

- Where $C_{NT,r}$ is consumption of a homogeneous nontraded good
- C_{sr} is consumption of tradeable sector s
- β's add up to 1.

Prices:

- $P_{NT,r}$ is the price index of the nontraded good.
- P_s is the price index of sector s.

Fajgelbaum et al. (2020) GE Structure

Production of tradeable goods in each sector-region uses labor, intermediate inputs, and a fixed factor.

- Capital and labor are immobile across regions and sectors (short-term model)
- Intermediate inputs can be freely adjusted.
- Domestic production of tradeable sector s in region r is:

$$Q_{sr} = Z_{sr} \left(\frac{I_{sr}}{\alpha_{I,s}} \right)^{\alpha_{Is}} \left(\frac{L_{sr}}{\alpha_{Ls}} \right)^{\alpha_{Ls}}$$

- Z_{sr} is local productivity, I_{sr} is a bundle of intermediates, L_{sr} is labor.
- Production share of the fixed factor is $\alpha_{K,s} \equiv 1 - \alpha_{Is} - \alpha_{Ls}$

Fajgelbaum et al. (2020) GE Structure

Intermediate inputs in sector s are aggregated using a Cobb-Douglas technology.

- $\alpha_s^{s'}$ is the share of input s' in total sales of sector s.
- Cost of intermediates bundle used by sector s is:

$$\phi_s \propto \Pi_{s' \in S} P_{s'}^{\frac{\alpha_s^{s'}}{\alpha_{Is}}}$$

- Owners of fixed factors choose I_{sr} and L_{sr} to maximize profits Π_{sr}, which are given by:

$$\Pi_{sr} = \max_{Q_{sr}} p_s Q_{sr} - (1 - \alpha_{Ks}) \left(\frac{\phi_s^{\alpha_{Is}} w_{sr}^{\alpha_{Ls}}}{Z_{sr}} Q_{sr} \right)^{\frac{1}{1-\alpha_{Ks}}}$$

where w_{sr} is the wage per worker in sector s and region r, and p_s is the producer price in sector s.

Fajgelbaum et al. (2020) GE Structure

Production by sector and region is allocated across products at a constant marginal rate of transformation, giving the feasibility constraint:

$$Q_s = \sum_{g \in \mathcal{G}_f} \frac{q_g}{z_g}$$

- where z_g is a product-level productivity shock.
- This is done because we observe employment by region at the sector level (NAICS 4), but not at the product level.
- Model equilibrium won't pin down where each good g is produced.

Fajgelbaum et al. (2020) GE Structure

Assuming perfect competition:

- Price of domestically produced variety of good g is:

$$p_{Dg} = \frac{p_s}{z_g}$$

- Price faced by importer i of product g is:

$$p_{ig}^X = \delta_{ig} p_{Dg}$$

- Hence, market clearing in the U.S. variety of product g requires:

$$q_s = \underbrace{(\alpha_{Dg} D_s) \left(\frac{p_{Dg}}{P_{Ds}} \right)^{-\eta}}_{\text{Domestic demand}} + \underbrace{\sum_{i \in \mathcal{I}} \delta_{ig} a_{ig}^* \left(\left(1 + \tau_{ig}^*\right) p_{ig}^X \right)^{-\sigma^*}}_{\text{Exports}}$$

Fajgelbaum et al. (2020) GE Structure

Lastly, close the model by assuming that:

- Labor income and profits are spent where they are generated.
- Total tariff revenue, R, is distributed to each region in proportion b_r to its national population share.
- Income D derived from ownership of foreign factors, owned by region r also in proportion to population. (D is the trade deficit.)
- Final consumer expenditures in each region r are therefore:

$$X_r = w_{NT,r} L_{NT,r} + \sum_{s \in S} w_{sr} L_{sr} + \sum_{s \in S} \Pi_{sr} + b_r (D + R)$$

Fajgelbaum et al. (2020) GE Structure

An equilibrium **given tariffs** consists of import prices, p_{ig}^{*}, domestic prices p_{Dg}, traded wages w_{sr}, nontraded wages $w_{NT,r}$, and price indices (P_s, P_{Ds}, P_{Ms}, p_{Mg}, ϕ_s), such that:

(i) Given these prices, final consumers, producers, and workers optimize

(ii) Local labor markets clear for everysector and region

(iii) International markets clear for imports and exports of everyvariety

(iv) Domestic markets for final goods and intermediates clear.

(v) Government budget constraint is satisfied.

Foreign demand and supply shifters, z_{ig}^{*} and a_{ig}^{*} are taken as given.

▸ Return