China's Trade Retaliation: Factuals vs. Counterfactuals

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It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness.
—Charles Dickens, 1859, *A Tale of Two Cities*

Overview

Intro

Trade theories show why and how countries should avoid trade wars. They do not say much about trade war practices. For example, if a trade war unfortunately happens, how do countries fight it? And how should they? And how should not they?

Modeling trade wars is challenging:

- The curse of dimensionality: motives, strategies, countries, products
- Few facts to build on: trade wars have been uncommon since Smoot-Hawley

The US-China Trade War is a rare research opportunity.

Our focus: the China side

Retaliation in an eye-for-an-eye (EFAE) fashion

US		China
6-15-2018: • Tranche 1: **effective 7-6-2018, 34bn USD, rate: 25%**	→	6-15-2018: • Tranche 1: **effective 7-6-2018, 34bn USD, rate: 25%**
• Tranche 2: **effective 8-23-2018, 16bn USD, rate: 25%**	→	• Tranche 2: **effective 8-23-2018, 16bn USD, rate: 25%**
7-10-2018: • Tranche 3: **effective 9-24-2018**, 200bn USD, rate: **10%**	→	9-18-2018: • Tranche 3: **effective 9-24-2018**, 60bn USD, rate: **up to 10%**
5-9-2019: • Tranche 3 continued: **rate raised to 25%**, effective 5-10-2019	→	5-13-2019: • Tranche 3 continued: **rate raised up to 25%**, effective 6-1-2019
8-13-2019: 300bn USD • Tranche 4 (half): **effective 9-1-2019**, rate: 15%	→	8-23-2019: 75bn • Tranche 4 (half): **effective 9-1-2019**, rate: 10%
October to December 2019: both sides disclosed ongoing negotiation. 1-15-2020: the two sides signed "Phase One Deal"		

Notes: Only actions that became effective later are included in the figure. US dollar values are taxable values officially announced by the two governments. Actions of the two sides mirroring each other are **in red**.

What we do

The Chinese side chose to mirror the US side in:

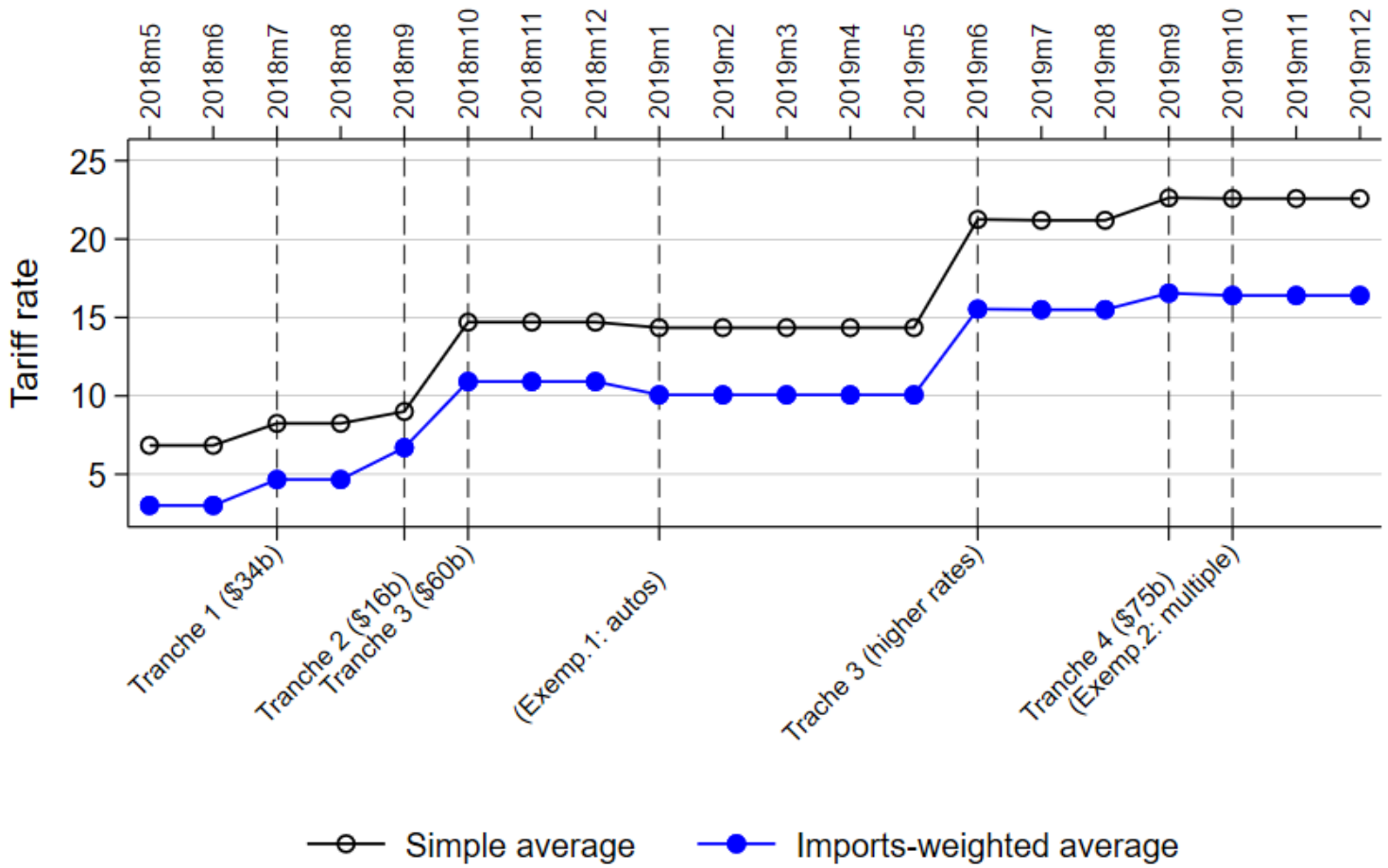
- Taxable values
- Tariff rates
- Timing

The product dimension is the only **dimension of variation**:

1. Forensics of the motive behind the factual retaliatory tariff schedule
2. Construct counterfactual retaliatory tariff schedules
3. Welfare analyses
   - factual VS counterfactual
   - counterfactual VS counterfactual
4. Finding the worst (-welfare) retaliatory tariff schedule

Background

Figure: China's Tariffs on US Products, 2018-2019



Literature

- Fajgelbaum et al. (2020) on domestic production and general equilibrium effects. Amiti et al. (2019) on the welfare costs imposed by Trump's tariffs on US consumers.
- Estimated pro-welfare effects of trade agreements serving as trade war prevention: Bagwell and Staiger (2011); Ossa (2014); Caliendo and Parro (2015) among others.
- Welfare evaluation (factual + counterfactual) framework for EFAE retaliations
  - Theory-backed retaliatory motives
  - Politicized protectionism, normative and positive
  - What could have happened (calamity of trade wars)

Overview

Framework: setup (FGKK)

Economic interests of importers:

$$U = \prod_s \left(\frac{C_s}{\gamma_s}\right)^{\gamma_s}, C_s \equiv \left(\sum_{g \in s} m_g^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}}, \text{ and } m_g = \left(\sum_i m_{gi}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}. \tag{1}$$

Sector: s, $\gamma^s \in (0,1)$, $\sum_s \gamma^s = 1$
Product: g
Variety: gi

- A "US product": technically, a variety: $gi = gUS$

Framework: welfare

The import price index of China is

$$P = \prod_s (P_s)^{\gamma_s}, P_s = \left(\sum_{g \in s} P_g^{1-\eta} \right)^{\frac{1}{1-\eta}}, \text{ and } P_g = \left(\sum_i p_{gi}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}. \tag{2}$$

The inverse of P is the measure of welfare.

Delivery price: $p_{gi} = (1 + t_{gi}) p^*_{gi}$
Producer price: $p^*_{gi} = z_{gi} m^{\omega}_{gi}$

Framework: tariffs

The post-retaliation tariff levied on an imported product is

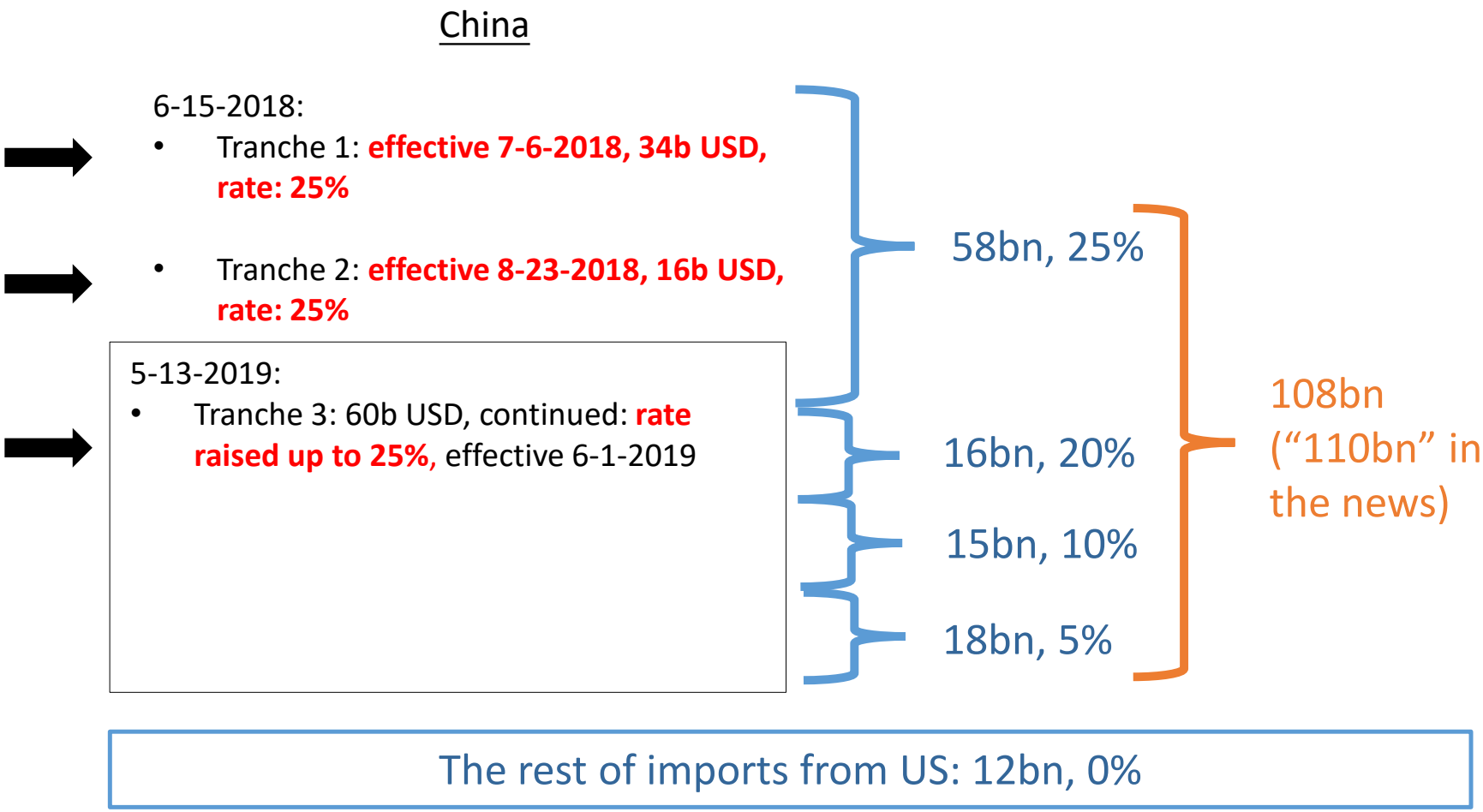
$$t_{gi} = \begin{cases} t^0_{gUS} + T_g, & \text{if } i = US, \\ t^0_{gi}, & \text{if } i \neq US. \end{cases} \tag{3}$$

- $T_g = 0$ for some g's, since not all US products were selected for retaliation
- $\{T_g\}$: China's retaliatory schedule against the US

Parameters

	(1)	(2)	(3)	(4)
Countries	All	All	US	All
Unit of observation	Country-HS8-month	Country-HS8-month	HS8-month	HS8-month
Structural parameter	$-\sigma$	ω	ω	η
Dependent variable:				
	Δln(quantity)	Δln(exporter price)	Δln(exporter price)	Δln(S)
Δln(tariff-ridden price, variety level)	-1.453***			
	(0.547)			
Δln(quantity, variety level)		0.521	0.270	
		(0.430)	(0.211)	
Δln(price, product level)				1.892
				(0.751)
Product × time fixed effect	Yes	Yes	Yes	Yes
Country × time fixed effect	Yes	Yes	Yes	Yes
Product × sector fixed effect	Yes	Yes	Yes	Yes
N	2,109,798	2,109,798	133,931	205,492

How did China retaliate



How did China retaliate, theoretical version

Characterized by two equations:

$$\sum_{g \in \{T_g^F > 0\}} p_{gUS}^{2017} m_{gUS}^{2017} = \$108\text{b} \equiv Q^F \tag{4}$$

$$T_g^F = \begin{cases} 25\%, & \text{if } Q \leq \$58\text{bn}, \\ 20\%, & \text{if } \$58\text{b} < Q \leq \$73\text{bn}, \\ 10\%, & \text{if } \$73\text{b} < Q \leq \$89\text{bn}, \\ 5\%, & \text{if } \$89\text{b} < Q \leq \$108\text{bn} (= Q^F). \end{cases} \tag{5}$$

Above: Factual (F) stats are used (b: billion USD)

Ranking function $\phi(\cdot)$

Consider a hypothetical decision maker who uses function $\phi(\cdot)$ to rank products. WLOG, $\phi'(\cdot) > 0$.

Λ_g is an arbitrary product characteristic rankable by $\phi(\cdot)$.

Existing and solvable: ϕ^{25}, ϕ^{20}, ϕ^{10} and ϕ^{5} such that

$$\begin{aligned}
\sum_{g \in \{\phi(\Lambda_g) \geq \phi^{25}\}} p_{gUS}^{2017} m_{gUS}^{2017} &= \$58\text{bn}, \quad \sum_{g \in \{\phi(\Lambda_g) \geq \phi^{20}\}} p_{gUS}^{2017} m_{gUS}^{2017} = \$73\text{bn}, \\
\sum_{g \in \{\phi(\Lambda_g) \geq \phi^{10}\}} p_{gUS}^{2017} m_{gUS}^{2017} &= \$89\text{bn}, \quad \sum_{g \in \{\phi(\Lambda_g) \geq \phi^{5}\}} p_{gUS}^{2017} m_{gUS}^{2017} = \$108\text{bn}.
\end{aligned} \tag{6}$$

Counterfactual tariff structure: (rates and products)

$$T_g^{CF} = \begin{cases} 25\%, & \text{if } \phi(\Lambda_g) \geq \phi^{25}, \\ 20\%, & \text{if } \phi^{25} > \phi(\Lambda_g) \geq \phi^{20}, \\ 10\%, & \text{if } \phi^{20} > \phi(\Lambda_g) \geq \phi^{10}, \\ 5\%, & \text{if } \phi^{10} > \phi(\Lambda_g) \geq \phi^{5}, \\ 0, & \text{if } \phi(\Lambda_g) < \phi^{5}. \end{cases} \tag{7}$$

This algorithm ensures

$$\sum_{g \in \{T_g^{CF} > 0\}} p_{gUS}^{2017} m_{gUS}^{2017} = \$108\text{bn} = Q^F \tag{8}$$

Intuition: the hypothetical decision maker uses her preferences (represented by $\phi(\cdot)$) to compile counterfactual retaliatory tariff schedule $\{T_g^{CF}\}$, which is **observationally equivalent à la margins** (7) **and** (8) to $\{T_g^F\}$.

In short...

Algorithm can generate $\{T_g^{CF}\}$ based on any (US) product variety characteristic Λ_g:

$$T_g^{CF} = \Xi\Big(\Lambda_g\Big) \tag{9}$$

such that and $\{T_g^F\}$ and $\{T_g^{CF}\}$ are observational equivalent.

Toy example: Higher tariffs are levied on physically heavy products: $\Lambda_g = Weight/unit$. (Of course, this $\Xi(\Lambda_g)$ is funny nonsense...)

Overview

Elaboration on $\Xi(\Lambda_g)$

Λ_g comes from trade theories that motivate retaliation:

1. **Optimal tariff theory:** Λ_g = inverse export elasticity
2. **Sale (SOE) protection:** Λ_g = GH-MG measure
3. **Comp. adv. (CA) sanctioning:** Λ_g = Revealed CA
4. **Swing state (SS) targeting:** Λ_g = product-level Trump SS index

Motive 1: Optimal tariff theory

- Optimal tariff theory (Bickerdike, 1907; Johnson, 1953; Broda et al., 2008) is the most obvious theoretical guide for setting trade-war tariffs

$$T_g^{CF,1} = \Xi\left(\Lambda_g^1 \equiv \left[\frac{dm_{gUS}}{dp^*_{gUS}} \cdot \frac{p^*_{gUS}}{m_{gUS}}\right]^{-1}\right) \tag{10}$$

- We follow Feenstra (1994) and Broda and Weinstein (2006) to estimate pre-trade war Λ_g^1

Motive 2: SOE (sale) protecting

- Unlike the trade policies driven by lobbies in Western democracies, the trade policies in China's political regime are influenced by state-owned enterprises (SOEs)
- We modified the tariff-setting formula motivated by the "protection for sale" framework (Grossman and Helpman, 1994; Goldberg and Maggi, 1999)

$$T_g^{CF,2} = \Xi\left(\Lambda_g^2 \equiv \frac{I_g - \alpha}{a + \alpha} \cdot \frac{R_g}{\sigma_g}\right) \tag{11}$$

where R_g is inverse import penetration ratio

Motive 3: CA sanctioning

- The China side may target comparative advantage goods of the US to empower its retaliation
- Various mechanisms such as coercion, alienation, and signaling (e.g., Mayer, 1977; Kaempfer and Lowenberg, 1988, 2007; Verdier, 2009).
- We follow Balassa (1965), Costinot et al. (2012), and French (2017) to construct a revealed comparative advantage (RCA) measure:

$$T_g^{CF,3} = \Xi\left(\Lambda_g^3 \equiv \frac{Z_{gUS}/Z_{g^0US}}{Z_{gi^0}/Z_{g^0i^0}}\right) \tag{12}$$

Motive 4: SS Targeting

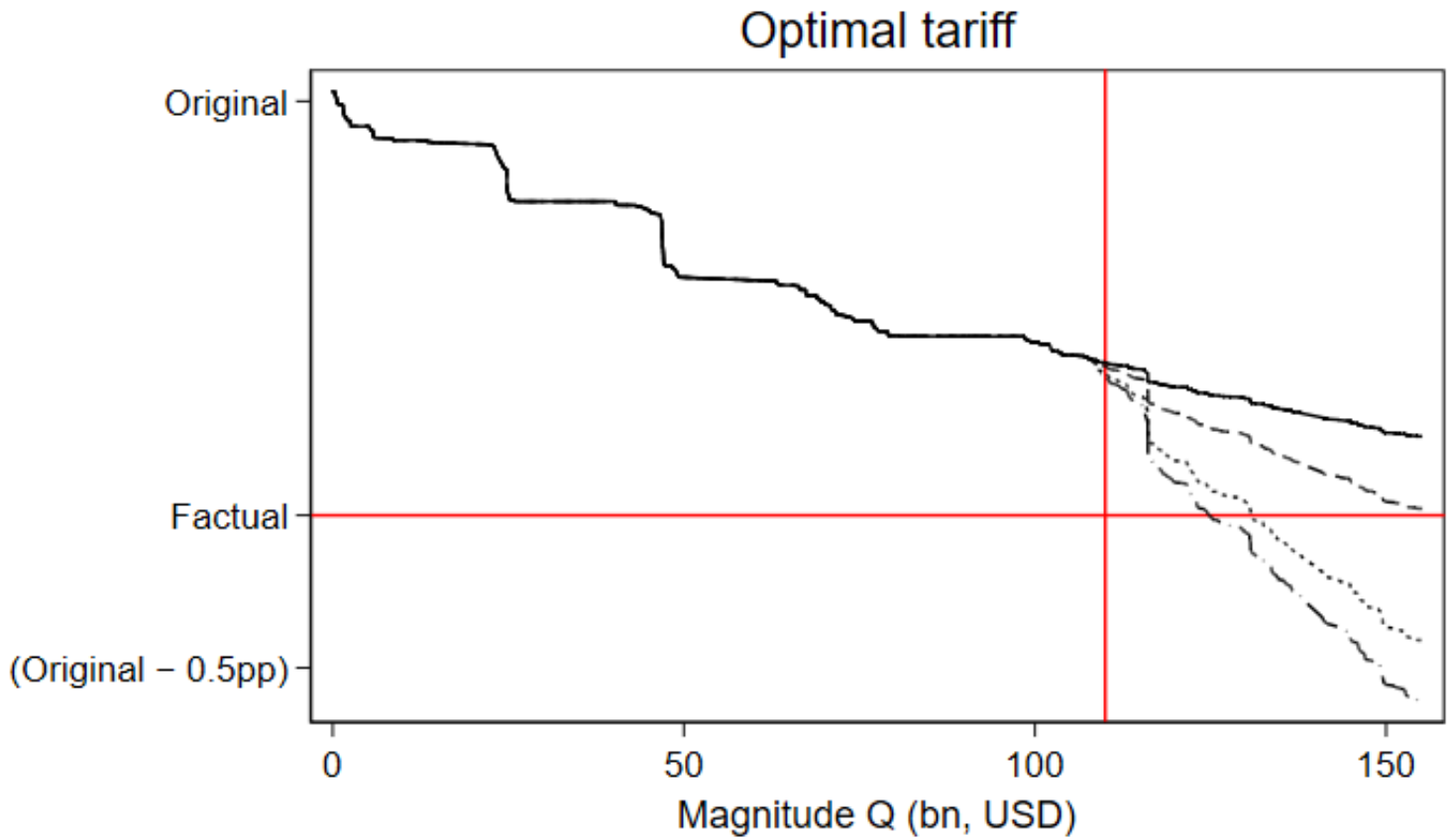
- Both recent studies and anecdotes link China's retaliation to the swing states that would influence Trump's reelection — Waugh (2019), Fetzer and Schwarz (2021), Kim and Margalit (2021), Bloomberg, The Guardian, MarketWatch, Yahoo! Finance...
- Theories on the importance of swing states/median voters in trade policymaking: e.g. Mayer (1984); Muûls and Petropoulou (2013); Ma and McLaren (2018)
- We construct a Trump's swing states index for each US product g:

$$T_g^{CF,4} = \Xi\left(\Lambda_g^4 \equiv \sum_{h \in Swing} \frac{L_{gh}}{L_h} \cdot TrumpVotes_h\right) \tag{13}$$

$\frac{L_{gh}}{L_h}$ is the share of labor related to US product g (Autor et al., 2013; Pierce and Schott, 2012)

Overview

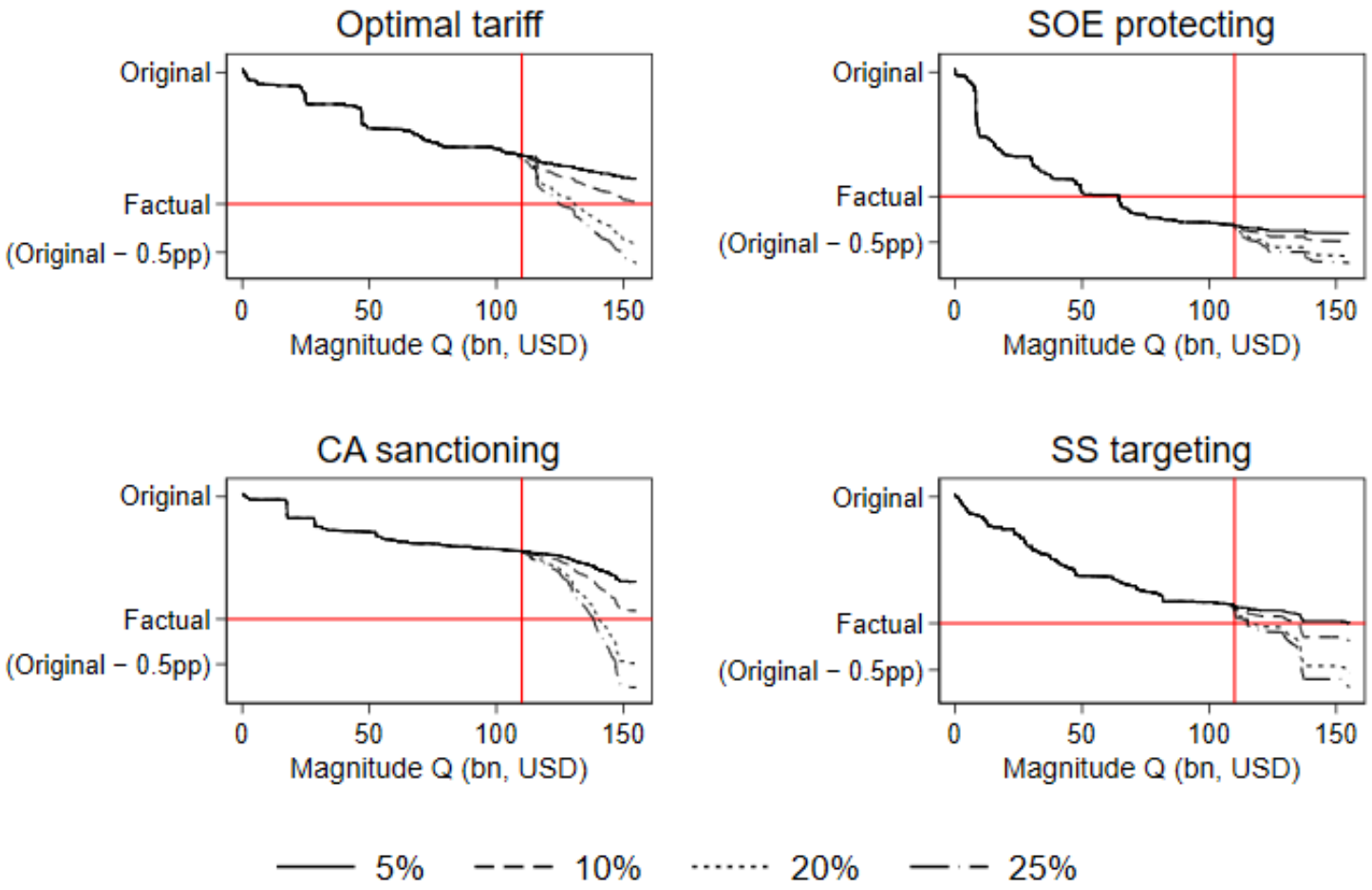
Result 1: welfare (pilot)



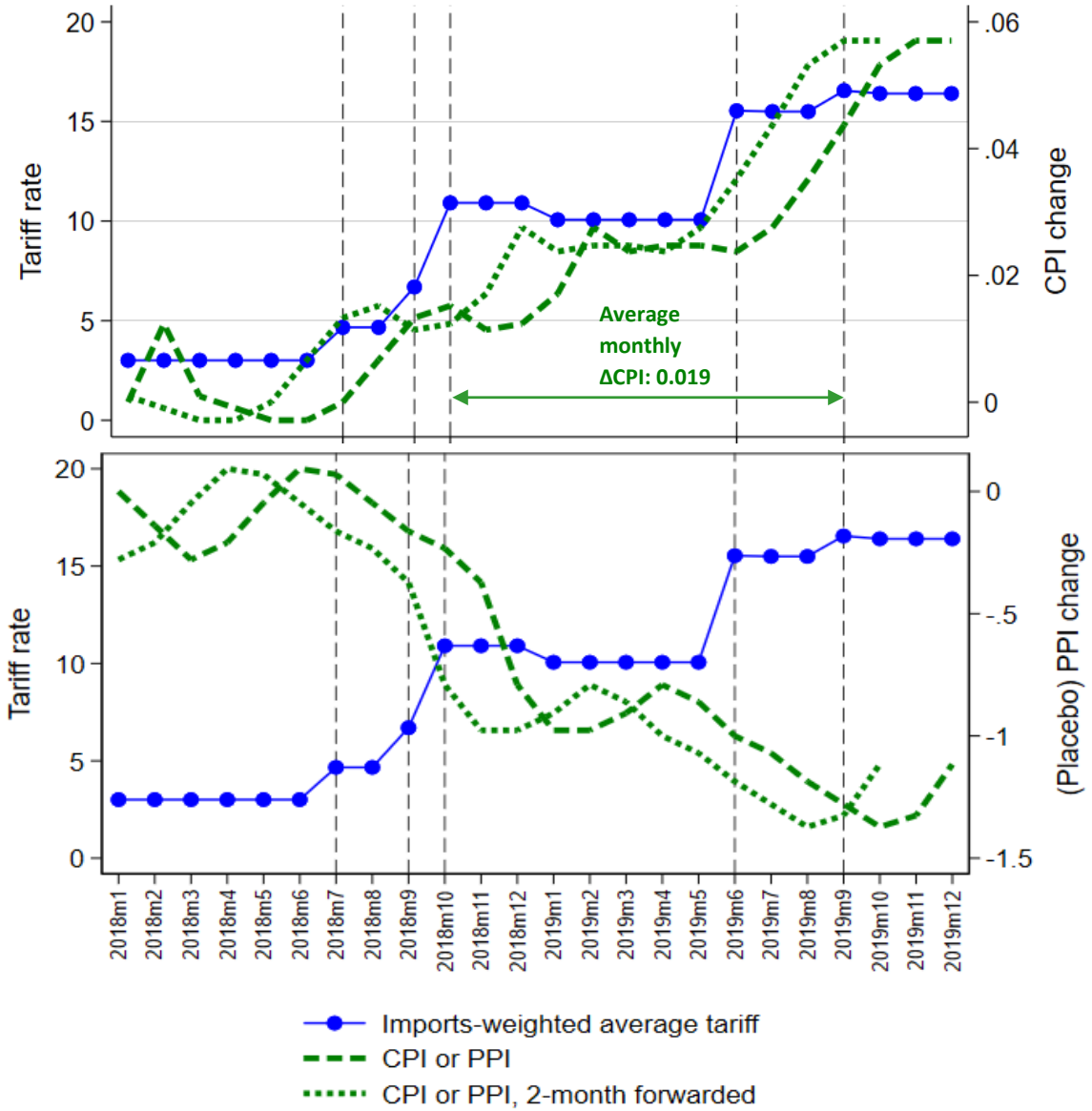
Counterfactual rates beyond the factual 110bn:

5% 10% 20% 25%

Result 1: welfare (full)



Result 1: CPI and PPI



Result 2: motive forensics

To make sense out of China's factual retaliatory schedule:

- Define $t_{gUS} = t^0_{gUS} + T^F_g$
- Let data speak:

$$t_{gUS} = \sum_1^4 \beta_k \Lambda^k_g + \mathbf{C_g \Gamma} + \mu_s + \epsilon_g \tag{14}$$

- Sample: China's imports from the US.
- Λ^k_g: the previous motive measures
- Parameters of interest: β_k, $k = 1$ to 4

Result 2: motive forensics

		Panel A: Benchmark results				
		Dep. Variable: retaliatory tariff rate (unit: percentage point)				
Optimal tariff		0.008				0.008
		(0.113)				(0.111)
SOE protecting			0.960			0.925
			(5.241)			(5.264)
CA sanctioning				0.002		0.003
				(0.006)		(0.006)
SS targeting					0.057**	0.058**
					(0.025)	(0.025)
Control variables:	Pre-war tariff rate	1.068***	1.068***	1.068***	1.066***	1.067***
		(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
	Rauch-differentiation dummy	0.077	0.084	0.081	0.023	0.030
		(0.539)	(0.533)	(0.540)	(0.530)	(0.519)
	Made-in-China 2025 dummy	-1.423***	-1.429***	-1.429***	-1.350***	-1.363***
		(0.452)	(0.448)	(0.440)	(0.446)	(0.434)
Observations		4,267	4,267	4,267	4,267	4,267
R-squared		0.530	0.530	0.530	0.530	0.530

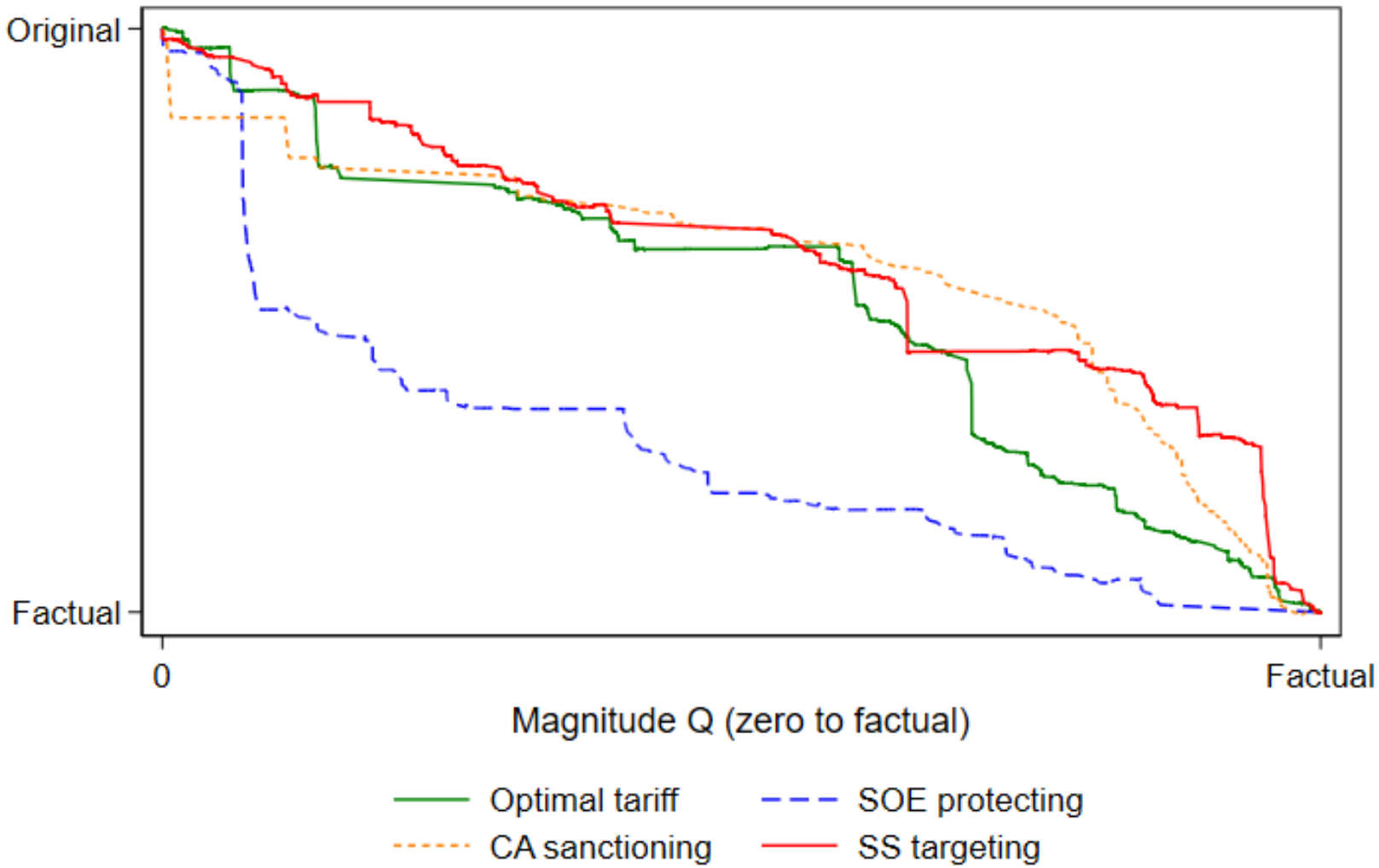
Notes : HS2 fixed effects are included in all regressions. Robust standard errors in parentheses, clustered at the HS2 level.*** p<0.01, ** p<0.05, * p<0.1.

Result 2: motive forensics, cont'd

	Panel D: Pre-war tariffs				
	Dep. Variable: pre-war tariff rate (unit: percentage point)				
Optimal tariff	-0.188				-0.188
	(0.183)				(0.182)
SOE protecting		-0.371			-0.354
		(0.475)			(0.421)
CA sanctioning			-0.011**		-0.010**
			(0.005)		(0.005)
SS targeting				0.048	0.045
				(0.043)	(0.043)
Control variables:					
Rauch-differentiation dummy	1.461***	1.423***	1.410***	1.377***	1.397***
	(0.446)	(0.431)	(0.430)	(0.418)	(0.434)
Made-in-China 2025 dummy	-0.522	-0.524	-0.498	-0.464	-0.434
	(0.491)	(0.520)	(0.523)	(0.474)	(0.458)
Observations	4,267	4,267	4,267	4,267	4,267
R-squared	0.467	0.466	0.466	0.467	0.468

Notes : HS2 fixed effects are included in all regressions. Robust standard errors in parentheses, clustered at the HS2

Result 3: counterfactual factuals



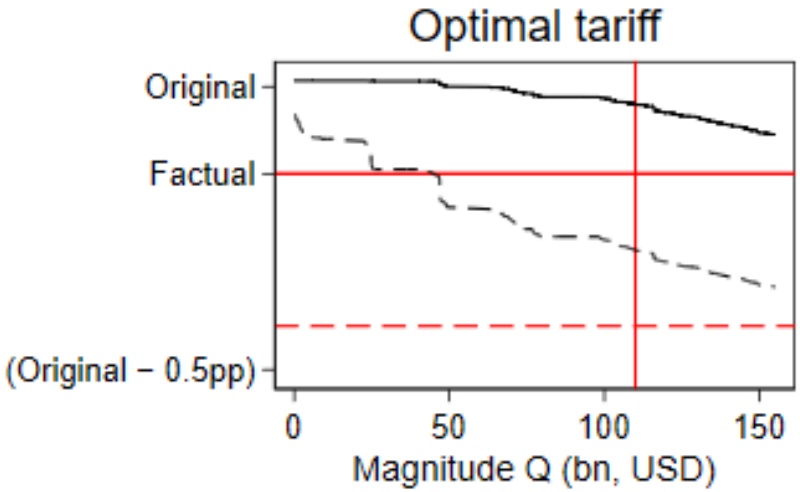
Result 4: potential TOT effects

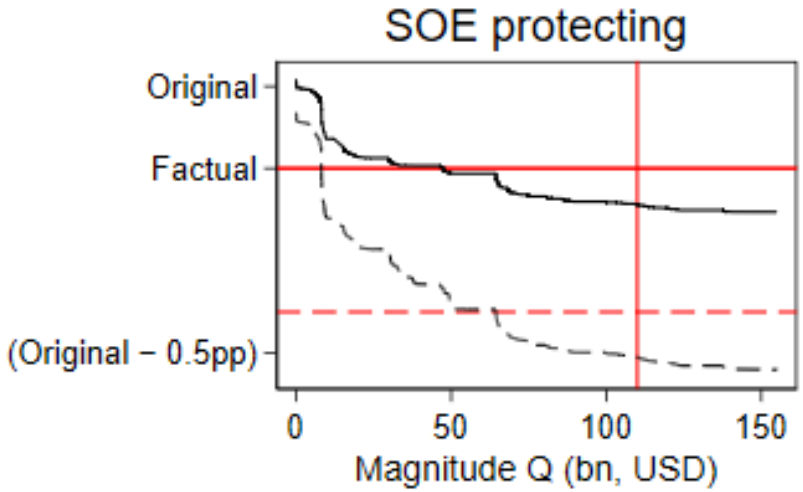
In theory, for a retaliatory tariff rate T_g, the burden falling on importers equals

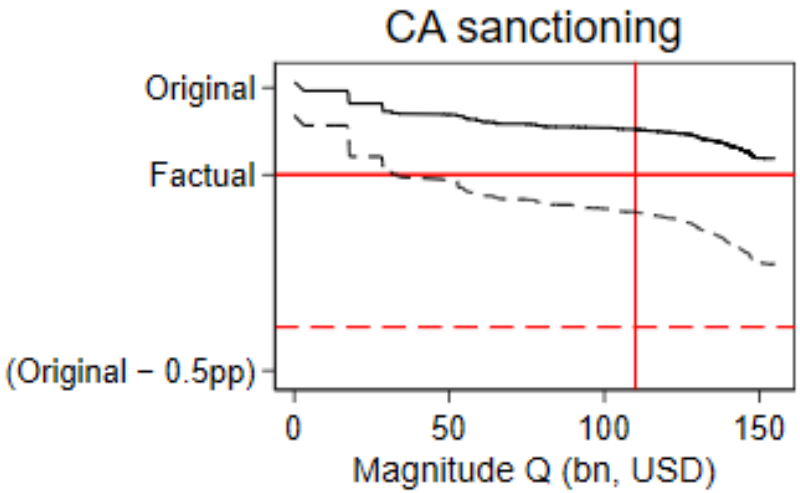
$$\breve{T}_g = \frac{1/\omega}{\sigma + 1/\omega} T_g \tag{15}$$

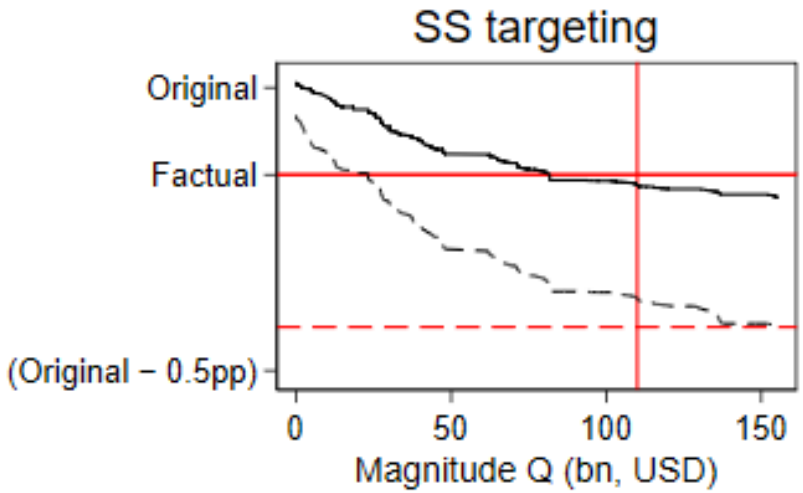
- Our earlier short-run estimate: $\hat{\omega}$ approaches zero so $\breve{T}_g$ approximates T_g
- What if we use long-run estimate Λ_g^1 for $1/\omega$:

$$\breve{p}_{gUS}(T_g, 1/\omega, p^*_{gUS}, t^0_{gUS}) = \left(1 + \frac{1/\omega}{\sigma + 1/\omega}(t^0_{gUS} + T_g)\right) \underbrace{\left(1 - \frac{\sigma}{\sigma + 1/\omega}(t^0_{gUS} + T_g)\right) p^*_{gUS}}_{\text{observed CIF price}} \tag{16}$$









Dashed lines reproduce the results without PTOT effects

Third-country incidence

When potential TOT effects are considered, third country incidence should also be considered. Intuitively, numerous third-country supply elasticities are affected by the retaliatory tariffs on US varieties. We derive, following Arkolakis, Costinot, and Rodriguez-Clare (2012),

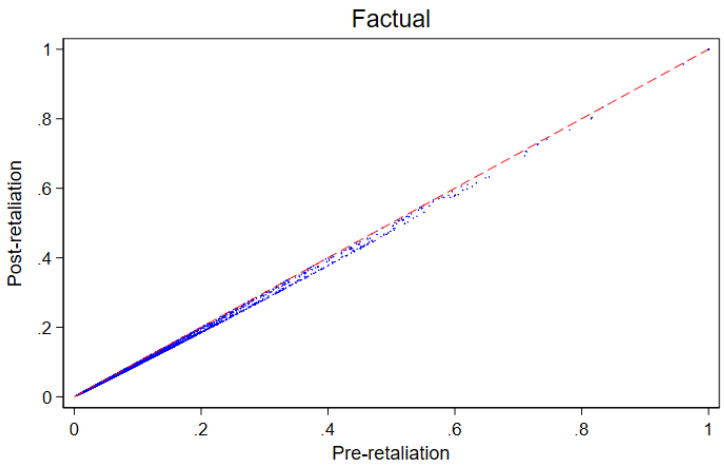
$$d \ln P_g = \frac{1}{\sigma - 1} d \ln \lambda_{gUS} + \Omega_{gUS} \tag{17}$$

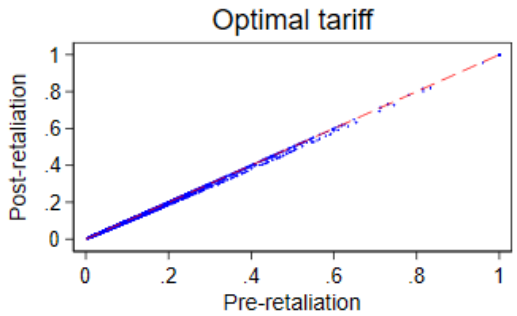
where Ω_{gUS} refers to the welfare implications with PTOT effects shown earlier. That is, with Ω_{gUS} partialled out, the market shares $\{\lambda_{gUS}\}$ serve as a sufficient statistic for all the omitted tax incidence.

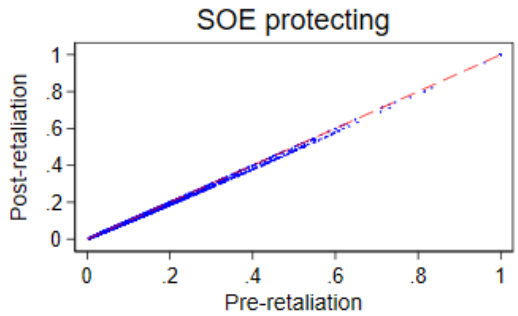
$\{\lambda_{gUS}\}$: pre-retaliation vs post-retaliation

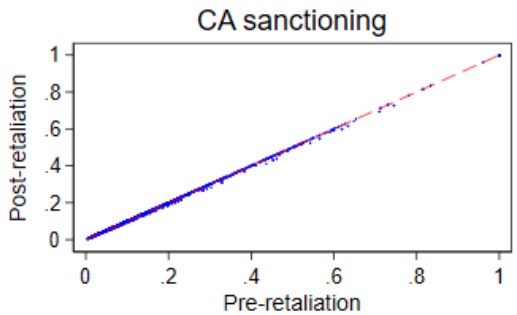
Post-retaliation:

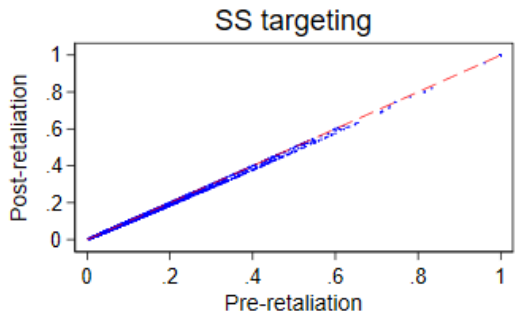
- Factual (left)
- Counterfactual (right-four)











Result 5: the worst scenario

In theory, how bad the retaliation's welfare consequence could have been?

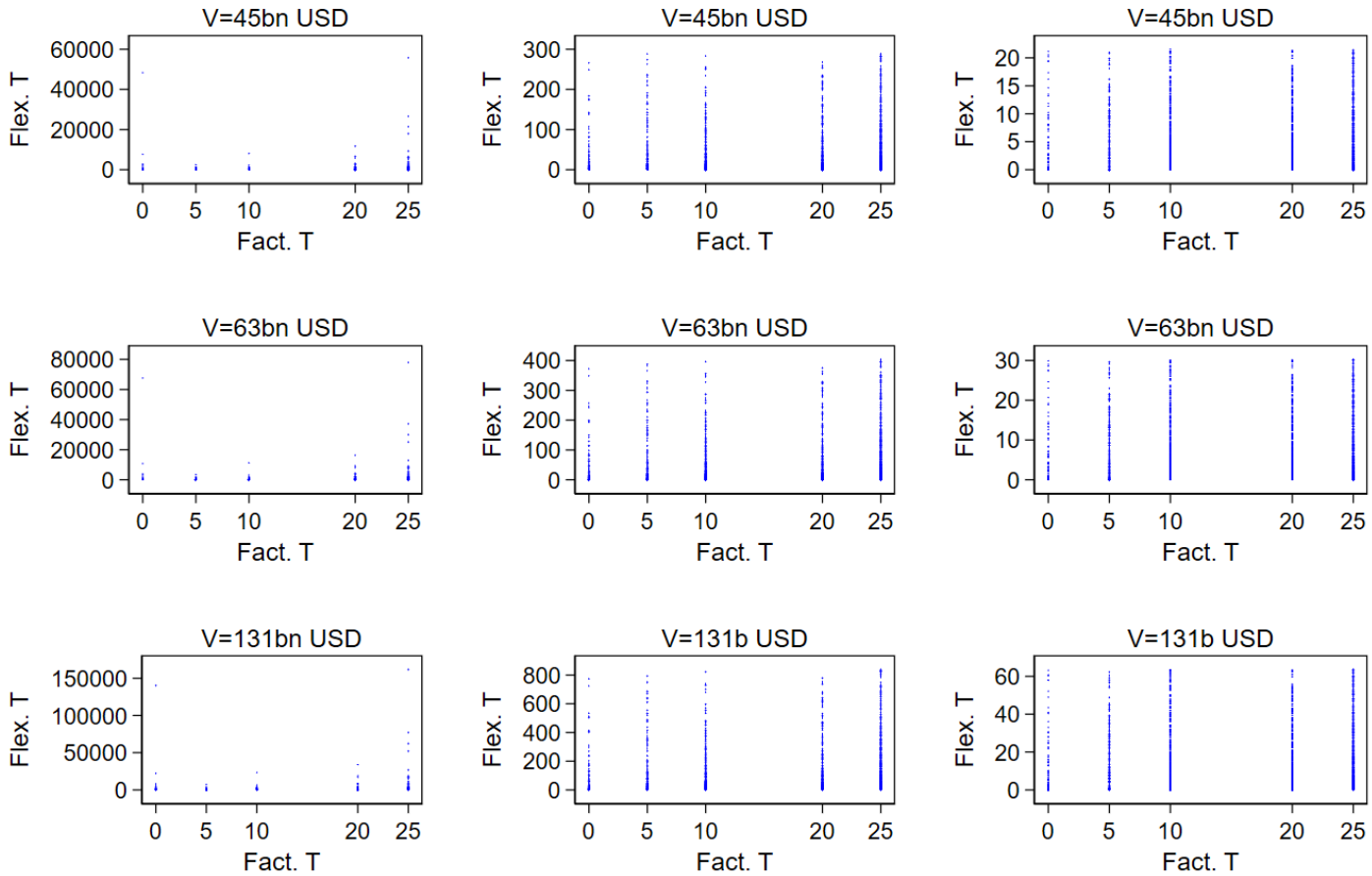
$$\begin{aligned} \underset{\{T_{gUS}\}}{\text{maximize}} \quad & \ln P \\ \text{subject to} \quad & \sum_{s} \sum_{g \in s} (1 + t^0_{gUS} + T_{gUS}) p^0_{gUS} m_{gUS} = V \end{aligned} \tag{18}$$

where V is tariff-ridden import value. V is unequal, but linkable, to Q. For instance, the cumulative Q by Tranche 3 (i.e., $Q_F \equiv \$108\text{bn}$), when tariff-ridden, equals

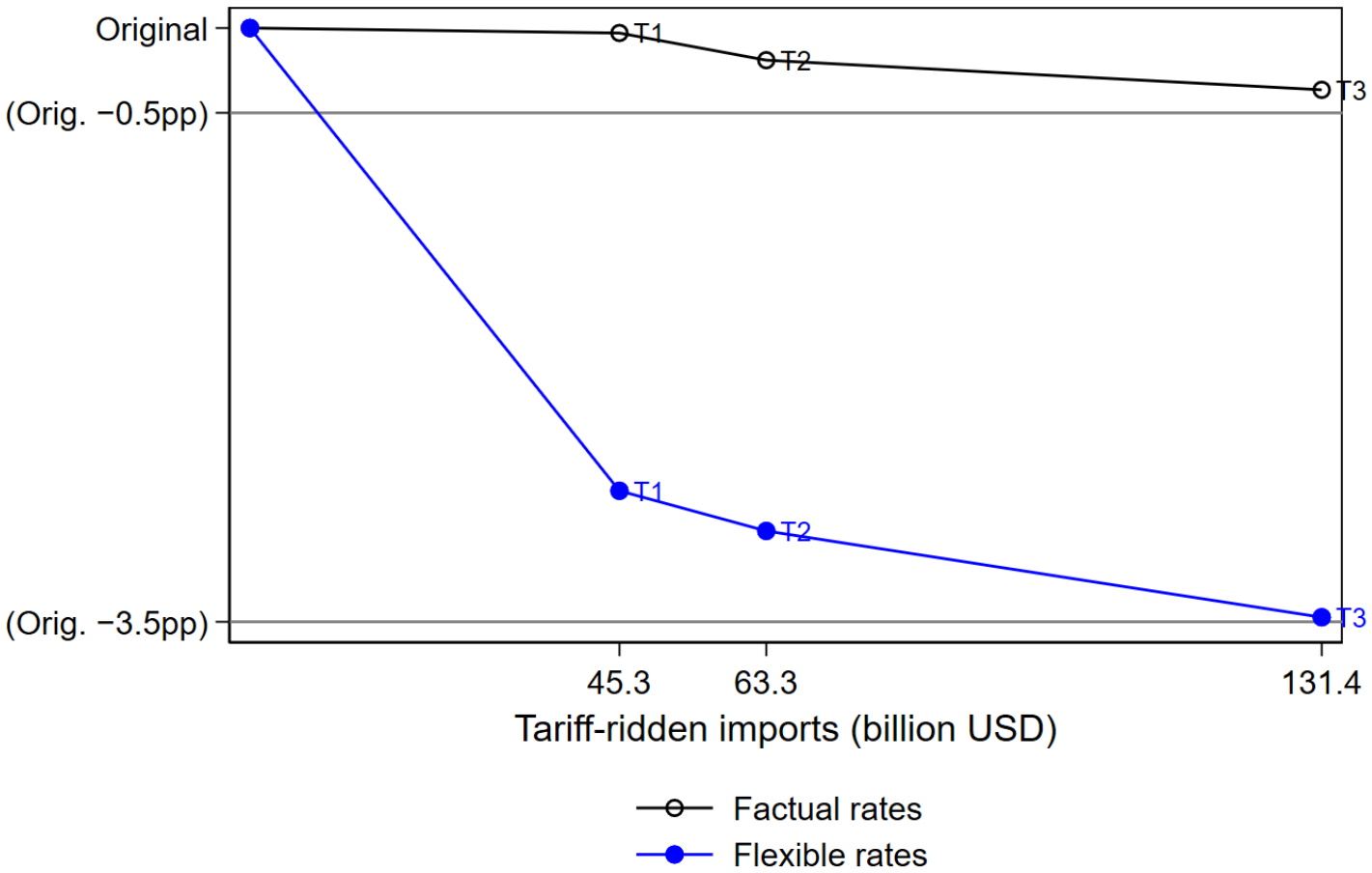
$$\sum_{g \in \{T^F_g > 0\}} (1 + t^0_{gUS} + T^F_g) p^{2017}_{gUS} m^{2017}_{gUS} = \$131\text{b} \tag{19}$$

Numerically solved $\{T^{+}_{gUS}\}$

- Customized for each US product variety (flexible rates)
- Interior solutions only (positive)
- Depending on V:



Could have been much worse...



Result 6: Reduced-form welfare analyses

Reduced-form measure (RFM) of welfare

$$RFM = -\mathbf{m^0} \cdot \mathbf{p}^* \cdot \mathbf{T} \tag{20}$$

Here, $\mathbf{m^0}$ is the vector of pre-retaliation import quantities, namely $\{m_{git^0}\}$ (in our case, the 2017 quantities of imports by China from the US). $\mathbf{p}^*$ is the vector of post-retaliation observed CIF prices, namely $\{p^*_{gi}\}$. $\mathbf{T}$ is the vector of retaliatory tariffs, namely $\{T_{gi}\}$.

- RFM is counterfactual-friendly.

Likewise...

	Factual	Counterfactual			
		Optimal tariff	SOE protecting	CA sanctioning	SS targeting
Value, billion USD	-62.8	-30.4	-63.0	-27.5	-27.9
(s.e.)	(27.2)	(5.9)	(23.4)	(7.8)	(4.7)
[95% c.i.]	[-116.1, -9.5]	[-42.0, -18.9]	[-108.9, -17.0]	[-42.8, -12.2]	[-37.2, -18.7]
% points of GDP*	-0.51	-0.25	-0.51	-0.22	-0.23
[95% c.i.]	[-0.94, -0.08]	[-0.34, -0.15]	[-0.88, -0.14]	[-0.35 -0.10]	[-0.30, -0.15]

Notes : The four columns under "Counterfactual" correspond to the four counterfactual retaliatory schedules (optimal-tariff, SOE-protecting, CA-sanctioning, and SS-targeting) respectively. Standard errors (s.e.) and confidence intervals [95% c.i.] are based on boostrapped product lists (1,000 times). * Points and interval estimates are based on the values above divided by China's 2017 GDP (12.31 trillion US dollars).

Take away

- Welfare consequence of factual retaliation: $-0.37pp$
- Inferred motive from factual retaliation: Trump SS
- Welfare ranking order of motives:

SOE protecting $<$ Factual $\approx$ SS targeting $<$ Optimal tariff $<$ CA sanctioning

- With possible TOT effects: net loss
- Worst welfare scenario: $-3.5pp$
- Reduced form estimation: similar