Trade war and peace

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Brief history of U.S.-China trade

1949: PRC established, not recognized by U.S.

1950–1970: Complete embargo

1971–1979: China exports to U.S. at Non-Normal Trade Relations (NNTR) rates

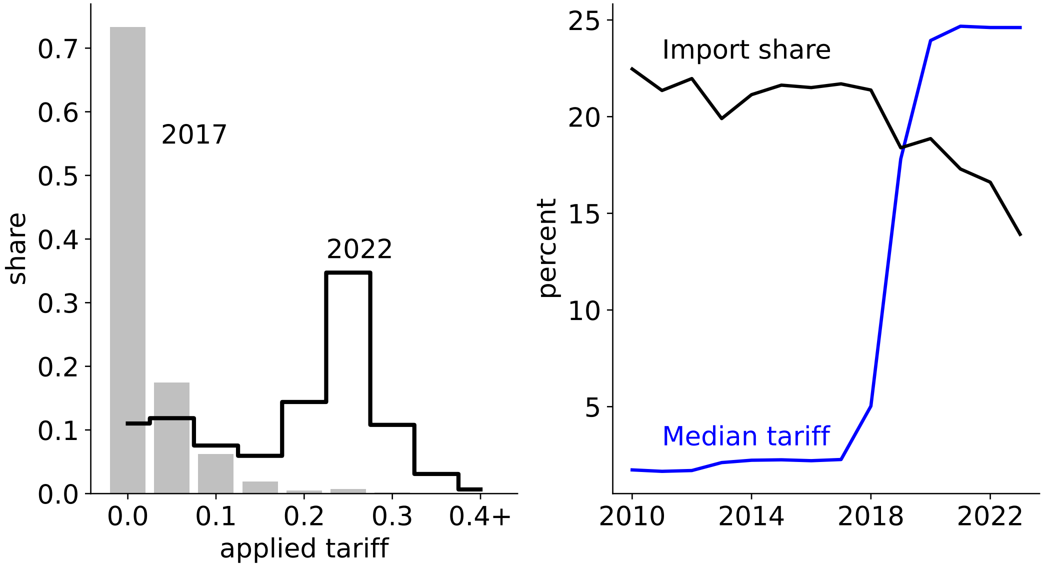
1980–2000: **Conditional** normal trade relations (NTR/MFN)

- Required annual President renewal
- Starting in 1990, Congress also voted on renewal

2001–2018: China joins WTO, gains permanent normal trade relations status

2018–????: Trump-Biden trade war (TW)

U.S.-China trade war



Goals, methods, and results

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  - How likely was the trade war?
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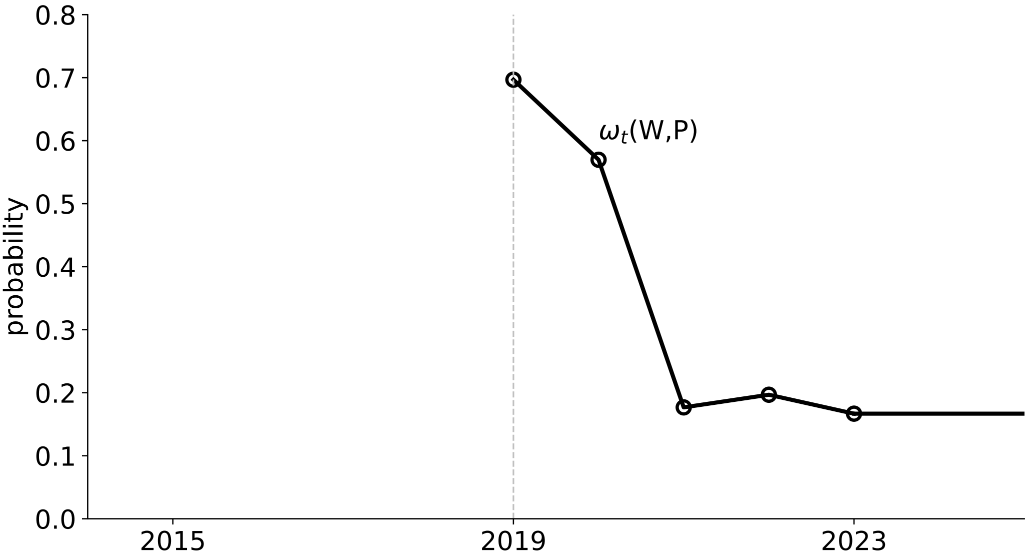
Regime probabilities



Outline

1. Introduction

2. Measuring responses to tariff risk in the data

3. Model of firm export decisions

4. Model + data $\rightarrow$ trade policy process

Empirics: Introduction

- Goal: how trade responds to two measures of policy risk — NNTR and TW tariffs

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- Goal: how trade responds to two measures of policy risk — NNTR and TW tariffs
- Data sources:
  - U.S. Customs trade data, includes import values and applied tariffs
  - Applied tariffs for NNTR, NTR and TW rates
- Unit of observation: source country (i) - good (g) - year (t)
  - 2014–2024, HS 6-digit level (3,500+ products)
  - Exclude goods with common tariff increase (steel, aluminum, etc)
  - Excludes new Biden tariffs
  - Alternative year definition: July–June (TW started in July 18)
- Results are summarized as a set of elasticities
  - These are not structural elasticities

The effect of future tariff risk

- Pierce and Schott (2016) measure of tariff risk pre-PNTR access:

$$X_g^{\text{NNTR}} = \text{NNTR tariff}_g - \text{NTR tariff}_g$$

  - Tariff increase if China lost NTR status pre-WTO
  - Most relevant risk pre-trade war (Russia moved to NNTR in 2022)

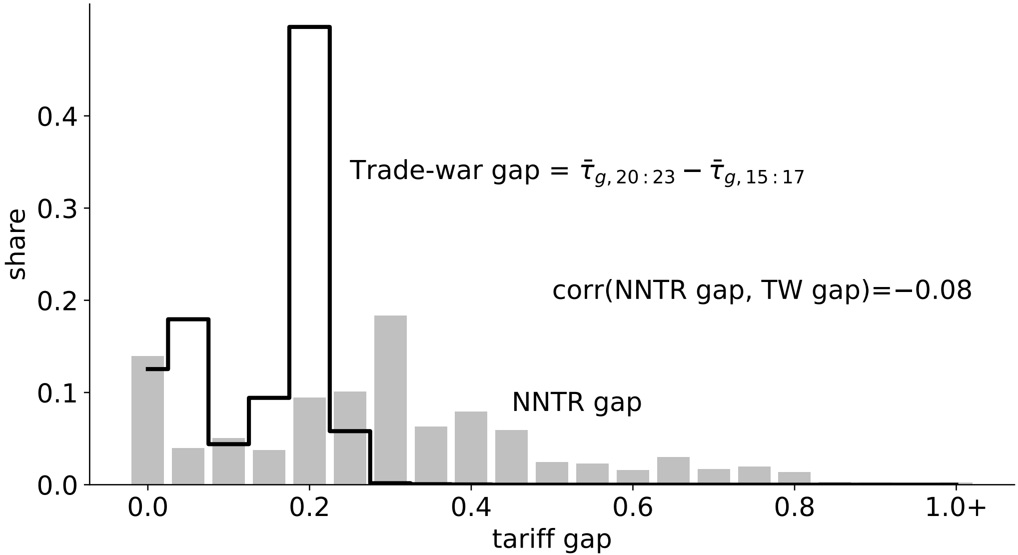
The effect of future tariff risk

- Pierce and Schott (2016) measure of tariff risk pre-PNTR access:

$$X_g^{\text{NNTR}} = \text{NNTR tariff}_g - \text{NTR tariff}_g$$

- Introduce a measure of trade war risk:

$$X_g^{\text{TW}} = \text{TW tariff}_g - \text{NTR tariff}_g$$


share
0.4
0.3
0.2
0.1
0.0
Trade-war gap = $\bar{\tau}_{g,20:23} - \bar{\tau}_{g,15:17}$
corr(NNTR gap, TW gap)=−0.08
NNTR gap
0.0
0.2
0.4
0.6
0.8
1.0+
tariff gap

Elasticity to the trade gaps

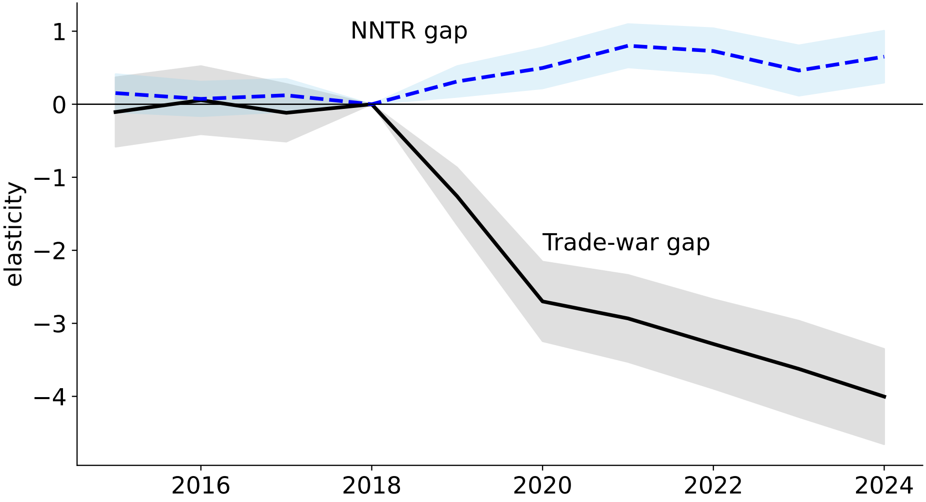
- Estimate year-by-year elasticity of trade to NNTR gap and TW gap

$$\log v_{igt} = \sum_{t'=2015}^{2023} \left(\beta_t^{\text{NNTR}} X_g^{\text{NNTR}} + \beta_t^{\text{TW}} X_g^{\text{TW}} \right) \mathbb{1}_{\{i=China \, \wedge \, t=t'\}}$$
$$+ \delta_{gt} + \delta_{ig} + \delta_{iht} + \alpha \log c_{igt} + u_{igt}$$

- v_{igt}: U.S. imports from source *i* of good *g*
- Control for the following (using fixed effects)
  - *gt*: good-level U.S. demand shocks, NTR trade policy
  - *ig*: imports of each good-country relative to a base period
  - *iht*: exporter-HS section level + exporter aggregate shocks (e.g. exchange rates)

β_t^{TW} = time-*t* elasticity of U.S. imports from China to the TW gap,
relative to other countries,
relative to 2018

Gap elasticities



- Before 2018: no substitution away from high tariff-gap goods
- Growing substitution away from high TW-gap goods
- Substitution towards high NNTR-gap goods (similar to WTO accession)

Robust to

- Using cross-product variation only
- Alternative fixed effects
- Sample of goods (balanced/unbalanced)
- Standard year definition
- Level of aggregation (HS8/HS10)
- China supply effects (δ_{jgt})

Data $\rightarrow$ model

- Lack of substitution before 2018
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Data $\rightarrow$ model

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- Growing substitution could be
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- Need a model to disentangle these forces

The model

- Model of Chinese producers considering exporting to United States
- Two key ingredients
  1. Gradual adjustment (exporter life cycle, Alessandria et al. 2021)
  2. Time-varying uncertainty over policy

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- Model of Chinese producers considering exporting to United States
- Two key ingredients
  1. Gradual adjustment (exporter life cycle, Alessandria et al. 2021)
  2. Time-varying uncertainty over policy
- G goods, matched to HS 6-digit tariffs
- Three tariff regimes (s): NNTR (N), NTR (P), TW (W)
- In each $g \in G$, fixed mass of producers
  - Standard monopolistic-competition setup
  - Fixed cost to enter export market and continue (f_0, f_1)
  - Heterogeneous, time-varying productivity (z), variable trade cost (ξ)
  - ξ, z, s are stochastic

Chinese producers: Static optimization

- Production (z = productivity; ℓ = labor)

$$y = z\ell \qquad z \sim \text{AR}(1)$$

- Firm-level demand (τ = tariff; D = aggregate shifter)

$$d_g(p,s) = \left(\tau_g(s)\,p\right)^{-\theta} D$$

- Given z, ξ, s, choose p, ℓ to max flow profits

$$\pi_g(z,\xi,s) = \max_{p,\ell} p\, d_g(p,s) - w\ell$$
$$\text{s.t.} \quad z\ell \geq d_g(p,s)\,\xi$$

Chinese producers: Exporter life cycle, dynamic optimization

- Variable trade cost (ξ) captures current export status
  - ∞: non-exporter
  - ξ_H: high-cost exporter
  - ξ_L: low-cost exporter
- All firms start as non-exporters ($\xi = \infty$)
- Costs of exporting in $t + 1$ depend on current export status in t
  - New exporters: pay f_0, start with high-cost (ξ_H)
  - Continuing exporters: pay f_1, switch to higher/lower cost with prob. $1 - \rho_\xi$

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- Given z, ξ, s, choose whether to export at $t+1$ to max PV of profits:

$$V_{gt}\left(z, \xi, s\right) = \pi_{gt}(z, \xi, s) + \max \left\{ \underbrace{-f(\xi) + \frac{\delta(z)}{1+r} \mathbb{E}_{z', \xi', s'} V_{gt+1}\left(z', \xi', s'\right)}_{\text{export}}, \underbrace{\frac{\delta(z)}{1+r} \mathbb{E}_{z', s'} V_{gt+1}\left(z', \infty, s'\right)}_{\text{don't export}} \right\}$$

- Export thresholds, $\widehat{z}_t(\xi, s)$, increases in current & future trade barriers

Aggregation, trade elasticities

- Aggregate exports in good g:

$$Y_{gt}(s) = \sum_{\xi \in \{\xi_L, \xi_H\}} \int_z p(z, \xi, s)\, d_{gt}(z, s)\, \varphi_{gt}(z, \xi)\, dz.$$

  - Per-firm sales (*pd*) depend on current tariffs
  - Distribution of productivity and export status (φ) depends on past and future tariffs
- Mapping to trade elasticities:
  - SR response to *unanticipated* reform: θ
  - LR response to *permanent* reform: $> \theta$, increasing in ξ_H/ξ_L and ρ_ξ

Calibration: overview

1. Set common parameters to standard values from literature
2. Set tariff schedules directly to data
3. Calibrate exporter life-cycle parameters to match Chinese firm-level data, 2004–2007
4. Estimate regime-switching probabilities to match our estimates of trade dynamics

Calibration: Timing and beliefs

- Begin in 2018, in “steady state” where NTR status has occurred for a very long time
- Trade war in 2019 is a surprise
- Yearly changes in probabilities are believed permanent
- (Explore alternatives in the paper)

Tariff regimes

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  - Trade war is a surprise
  - Downside risk is returning to NNTR

$$\Omega^P = \begin{bmatrix} \omega(P,P) & 1-\omega(P,P) & 0 \\ 1-\omega(N,N) & \omega(N,N) & 0 \\ - & - & - \end{bmatrix}$$

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- Regime-switching probabilities after the trade war
  - Do not return to NNTR
  - Downside risk is the trade war

$$\Omega_t^W = \begin{bmatrix} \omega(P,P) & 0 & 1-\omega(P,P) \\ - & - & - \\ 1-\omega_t(W,W) & 0 & \omega_t(W,W) \end{bmatrix}$$

- Estimate $\omega(P,P)$ and $\{\omega_t(W,W)\}_{t=2019}^{2023}$ to match the gap elasticities

Calibration: Assigned parameters

Parameter	Meaning	Value	Source/target
r	Interest rate	4 pct.	Standard
ρ_z	Persistence of productivity	0.65	Alessandria et al. (2021)
δ_0	Corr.(survival,productivity)	21.04	"
δ_1	Minimum death probability	0.023	"
$\tau_g(N)$	NNTR tariff	Varies by good	Data
$\tau_g(P)$	NTR tariff	Varies by good	Data
$\tau_g(T)$	Trade-war tariff	Varies by good	Data
$\theta_{\gamma(g)}$	Demand elasticity	Varies by sector	Soderbery (2018)
ρ_ξ	Prob. of keeping iceberg cost	0.91	Alessandria et al. (2024)
$\omega(N, N)$	Prob. of staying in NNTR	0.71	"

- Probability of exogenous exit

$$1 - \delta(z) = \max\{0, \min\{e^{-\delta_0 z} + \delta_1, 1\}\}$$

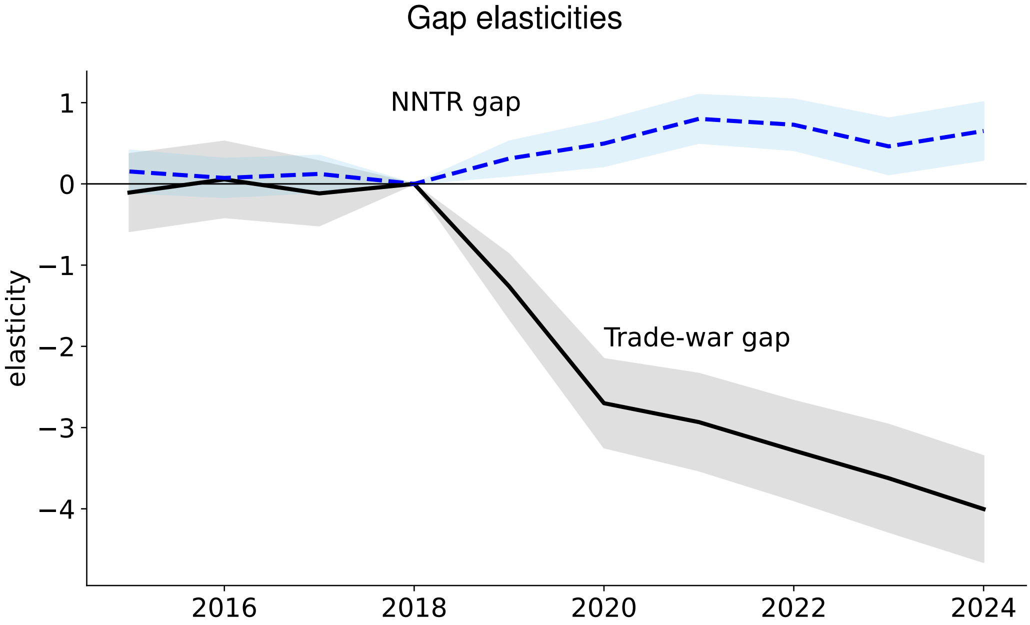
Calibration: Exporter life cycles

- Assign goods to 15 industries, compute industry-level exporter dynamics moments using Chinese firm-level data for 2004–2007
- Calibrate entry cost (f_0), continuation cost (f_1), high iceberg cost (ξ), prod. dispersion (σ_z) for each industry to match moments in initial "steady state"

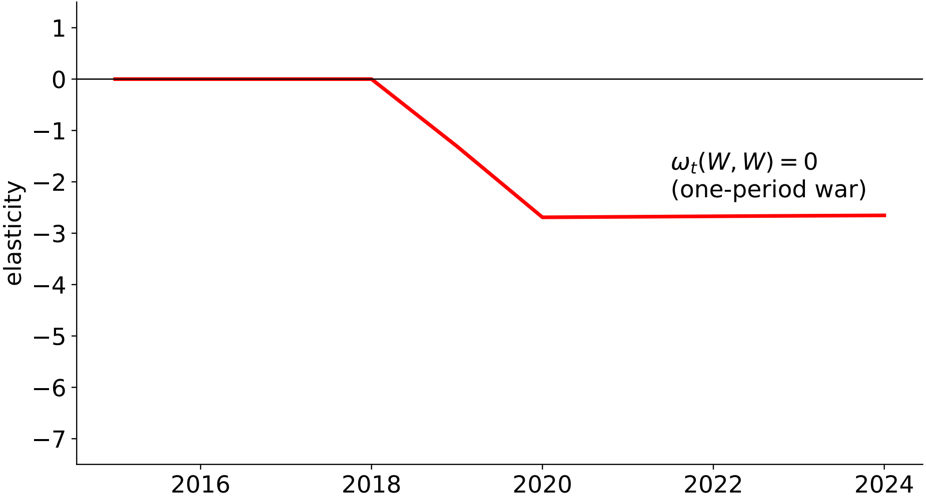
	Firms	Export part. rate (%)	Exit rate (%)	Incumbent size prem.	Log CV exports
Base metal manufacturing	49,070	12	21	3.96	1.15
Calendered metal manufacturing	59,774	29	10	2.48	1.24
Computer, electronic and optica..	52,913	48	7	4.82	1.94
Electrical equipment manufactur..	65,832	32	10	3.35	1.55
Energy products and chemicals	112,272	19	15	3.23	1.48
Food, beverage and tobacco	98,180	19	16	2.71	0.91
Furniture and other manufacturing	50,222	59	7	1.76	0.95
Non-metallic mineral products	83,944	16	18	2.26	0.85
Other machinery and equipment	132,758	23	13	3.33	1.54
Paper and printing products	49,724	12	17	3.10	1.30
Rubber and plastic products	64,662	29	10	2.69	1.08
Textile, clothing, leather	174,957	45	10	1.99	1.06
Vehicle manufacturing	47,995	23	12	4.07	1.31
Wood and straw products	24,075	24	13	2.05	1.09

Calibrating to aggregate transition dynamics

- Indirect inference approach: DiD regressions in the model
    1. NNTR-gap coefficients
    2. Trade-war gap coefficients
- Note: β_t^{NNTR} and β_t^{TW} are
    - Reduced-form estimates, not structural parameters
    - Affected by presence of TPU


Gap elasticities
NNTR gap
Trade-war gap
elasticity
1
0
−1
−2
−3
−4
2016
2018
2020
2022
2024

Identifying trade war persistence: Trade-war gap elasticity



- Believe trade war ends next period $\rightarrow$ No change in entry/exit

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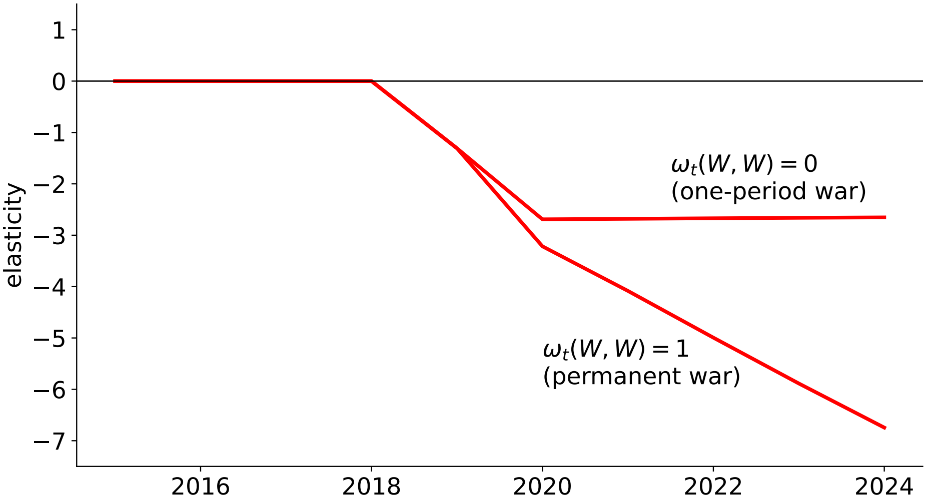

- Believe trade war ends next period $\rightarrow$ No change in entry/exit
- Believe trade war is permanent $\rightarrow$ Big changes in entry/exit

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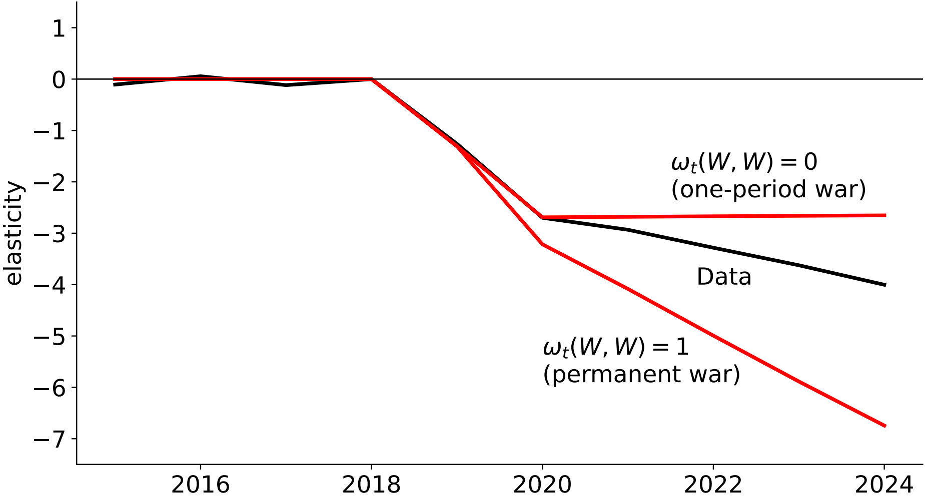

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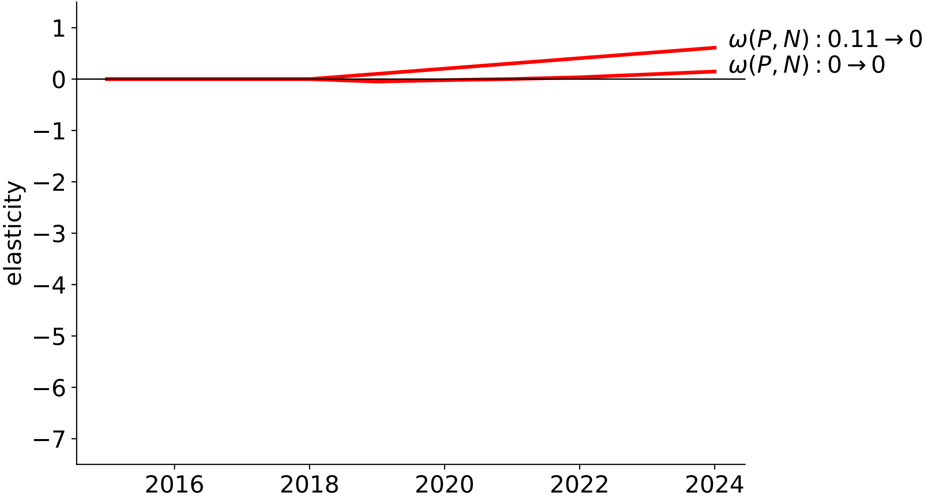
Identifying NNTR risk: NNTR gap elasticity



- No change in prob. of NNTR → Only change from correlation in gaps
- Prob. of NNTR falls → Substitution towards goods with higher NNTR gaps

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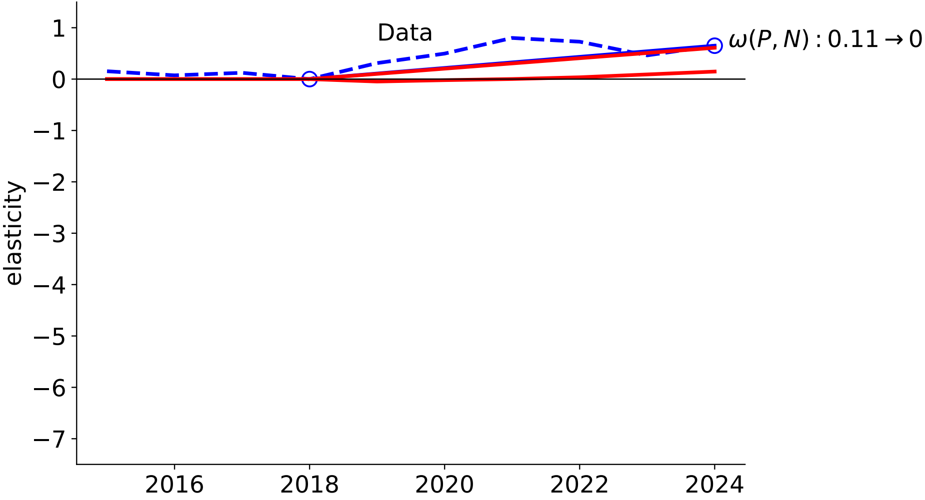

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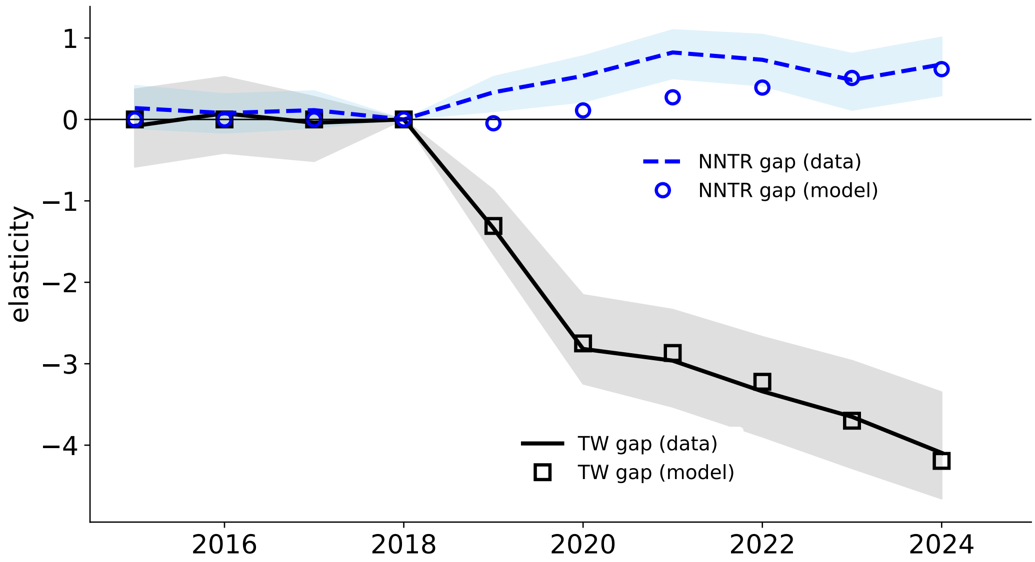
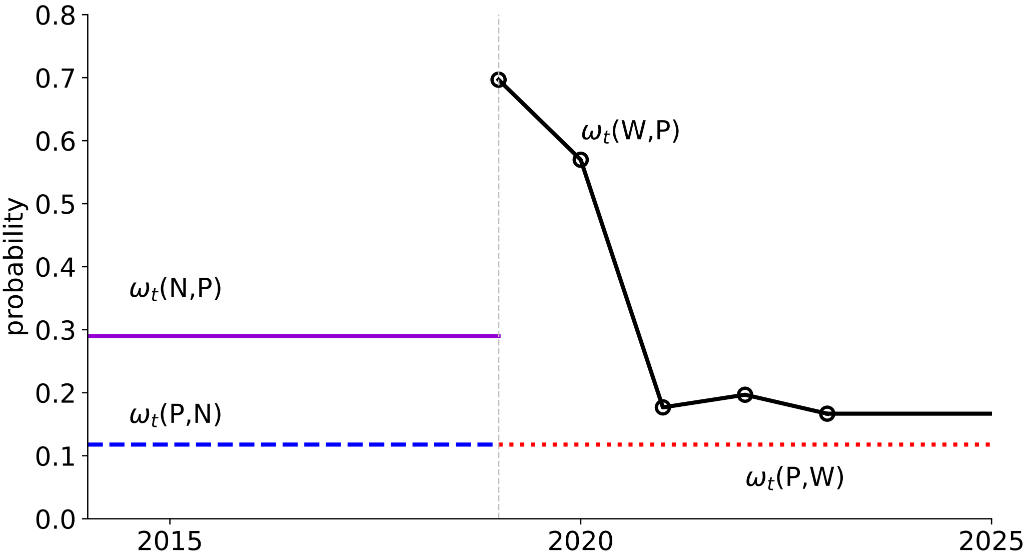
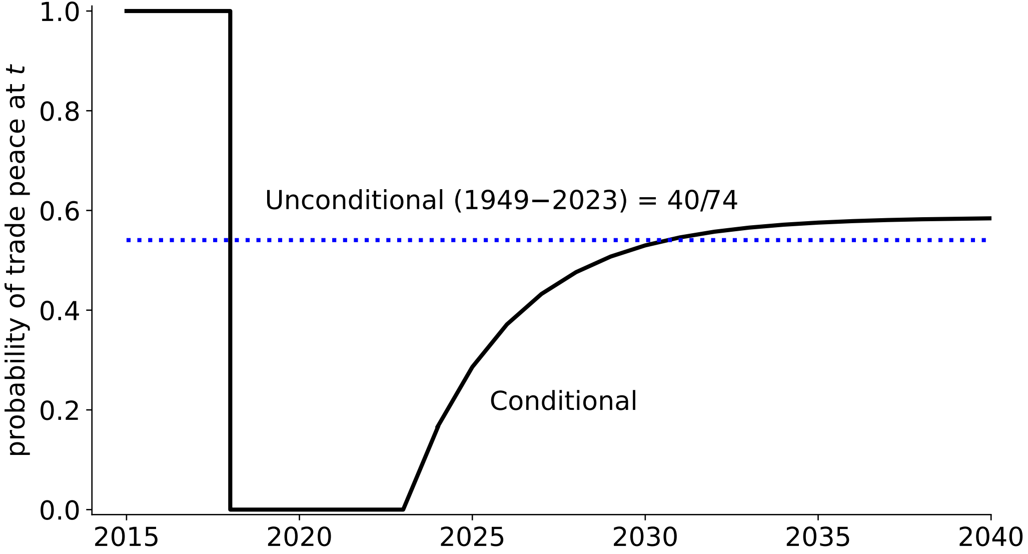
Matching Gap Elasticities



Regime probabilities



Probability of trade peace (2024 estimate)



Trade-policy innovations by administration

	Trump	Biden
Change in mean applied tariff (%)	17.2	0.0
Expected duration (years)	1.8	6.0
Change in mean discounted tariff (%)	−4.1	4.7

Trump: Large change in tariffs, expected to be short-lived

Biden: No change in tariffs, low probability of trade peace

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. . . you know if she doesn't like 'em they should have gone out and they should have immediately cut the tariffs but those tariffs are there three and a half years now under their administration. – Donald J. Trump, September 10, 2024

Lack of anticipation

- Paraphrasing a referee: “everyone knew Trump would increase tariffs”

Did firms not believe Trump?

Lack of anticipation

- Paraphrasing a referee: "everyone knew Trump would increase tariffs"

  Did firms not believe Trump?

- In 2016, firms believe: trade war in 2019 and tariff increase

$$\Delta\tau_g = \rho\Delta\tau_{gw} + (1-\rho)\Delta\hat{\tau}_g$$

  $\Delta\tau_{gw}$ = realized change in tariffs

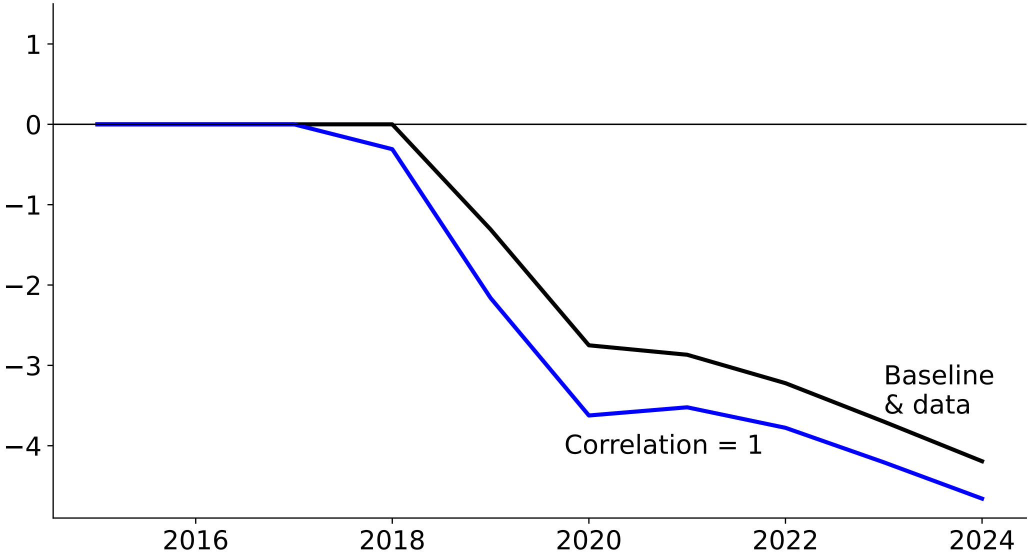
  $\Delta\hat{\tau}_g$ = random draw from empirical trade-war gap distribution

  $\rho = 0$: belief uncorrelated with realization (nests uniform change in tariffs)

  $\rho = 1$: perfectly anticipated

- In 2019, the trade war begins and firm face $\Delta\tau_{gw}$

Trade-war gap elasticities



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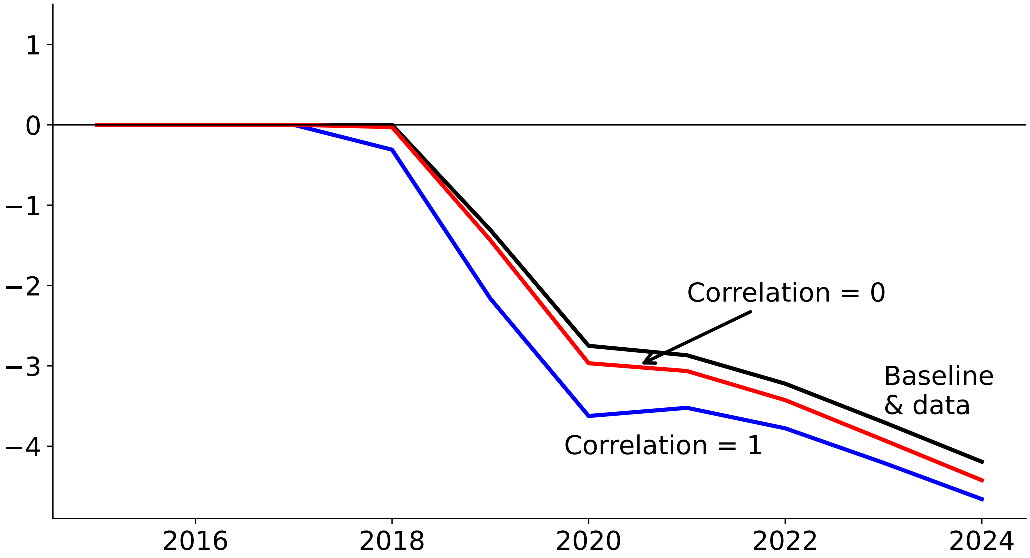

Wrapping up

- Policy is a complex stochastic process
- Trade policy's structure allows identification of conventional risks
- Changing beliefs over policy amplify/dampen its effectiveness

References

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