Recovering Credible Trade Elasticities from Incredible Trade Reforms

Alessandria, Khan, Khederlarian, Ruhl, and Steinberg

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Intro

- Trade elasticity: most important concept in international economics
- Structural interpretation: response to “canonical” reform: unanticipated & once-and-for-all
- Reduced form estimates: vary widely, both across time horizons but also across contexts

- This paper: canonical reforms don’t exist in the data!
  - Empirical: compare “more-canonical” vs. “less-canonical” reforms
  - Quantitative: recover canonical elasticity by feeding data through structural model

Dynamic policy, dynamic trade

- Trade is dynamic
  - Export participation decision are forward-looking due to front-loaded costs, back-loaded returns
- Policy is also dynamic
  - Anticipation: PTAs, GATT rounds negotiated & gradually phased in
  - Uncertainty: Brexit, U.S-China trade war, ongoing threats to Canada & Mexico

→ Trade depends on underlying stochastic policy process, not just observed sequence of realizations

→ Same observed policy change can generate different trade responses under different expectations

Preview: empirics

- U.S. import data from 1974–2017

- Assign country-product-year observations into regimes: NNTR, MFN, PTA, UTPP. Compare tariff & trade dynamics within regimes vs. across regimes.
  - Within regimes: Common & transitory, low trade elasticities (esp. in LR)
  - Across regimes: Rare & persistent, high trade elasticities (esp. in LR)
  - Sample mostly comprised of within-regime changes $\Rightarrow$ full-sample estimates get responses to major reforms wrong

- Case studies: China & Vietnam
  - Same policy path: Embargo $\rightarrow$ NNTR $\rightarrow$ conditional MFN $\rightarrow$ "permanent" MFN
  - More persistent tariffs, higher LR trade elasticities than typical regime switch
  - Different trade dynamics in SR $\Rightarrow$ different expectations

Preview: model

- Heterogeneous firms, sunk entry costs, fixed costs probabilistically improve market access
  - Alessandria, Choi, and Ruhl (2021) with many goods in partial equilibrium
- Illustrate measurement biases from non-canonical policy dynamics
  - Expected future tariffs change less than observed tariffs $\Rightarrow \downarrow$ LR elasticity
  - Expectations change before policy $\Rightarrow \uparrow$ SR elasticity
- Recover canonical trade elasticity using China & Vietnam case studies
  - Estimate regime-switching probability to match reduced-form elasticity path as in Alessandria et al. (2025a)
  - Conduct counterfactual canonical reform. LR elasticity ≈ 14.
  - Reduced-form LR elasticity biased $\downarrow$ due to anticipation of MFN grant, positive prob. of NNTR (even after WTO!)
  - Reduced-form SR elasticity biased $\uparrow$ for Vietnam due to rising prob. of MFN access

Related Literature

- Strands:
  - Trade dynamics (data): Galloway et al. (2003), Baier-Bergstrand (2007), Yilmazkuday (2019), Khan-Khederlarian (2020), Boehm et al. (2023)
  - Trade dynamics (models): Baldwin-Krugman (1989), Das et al. (2007), Alessandria-Choi (2007), Ruhl-Willis (2017), Alessandria et al. (2021), Steinberg (2024), Fitzgerald et al., (2024)
  - Trade-policy uncertainty: Ruhl (2011), Pierce-Schott (2016), Handley-Limão (2015 & 2017), Steinberg (2019), Caldara et al. (2020), Bianconi et al. (2021), Alessandria et al. (2025ab)

- Lessons:
  - → Reduced-form estimates biased by interactions between forward-looking decisions and policy dynamics
  - → Some reforms "more canonical" than others. Estimates from "less canonical" reforms lack exteral validity.
  - → Disentangling effects of past reforms vs. anticipation & uncertainty requires model
  - → Ideal setting: well-specified policy process and few realized policy changes

Roadmap

1. Empirical evidence
2. Model + numerical experiments
3. Calibration + recover structural elasticity

Data

- Sample: U.S. imports from 1974–2017
  - Captures transition from higher tariffs in 70s & 80s to low tariffs today
  - Covers major reforms: China's NTR grant, NAFTA, GATT rounds, GSP, etc.
- Aggregation: 5-digit SITC rev. 2
  - 1974–1988 U.S. imports at 8-digit TS-USA level: Concordance by Feenstra (1996)
  - 1989–2017 U.S. imports at 8-digit HTS level: Concordance using UNCTAD
- 44 years (t), 163 countries (j), 2,032 goods (g), 2,279,579 observations (jgt)
- Policy at jgt level: applied tariff (=duties/FOB imports)
  - Potentially different from scheduled tariffs due to aggregation, measurement error, etc.
  - Same jgt can have transactions under different schedules due to rules of origin, GSP requirements, etc.

Approach #1: Within vs. across tariff regimes

- Four statutory policy regimes: **MFN**, Non-Normal Trade Relations (**NNTR**), Preferential Trade Agreement (**PTA**), Unilateral Trade Preference Program (**UTPP**)
- Compare policy and trade dynamics within vs. across regimes

Tariff changes

From	To	N # *jgt*	Mean (p.p.)	Median (p.p.)	Std. dev. (p.p.)
(a) Within					
NTR	NTR	1,352,360	-0.15	0.00	9.47
NNTR	NNTR	10,542	-0.25	0.00	9.25
PTA	PTA	75,910	-0.12	0.00	1.34
UTPP	UTPP	149,526	-0.03	0.00	1.04
(b) Across					
NNTR	NTR	1,523	-27.63	-26.17	24.04
NTR	PTA	10,291	-3.01	-1.80	4.57
NTR	UTPP	29,860	-4.02	-2.90	14.53
Total		1,671,098	-0.17	0.00	8.92

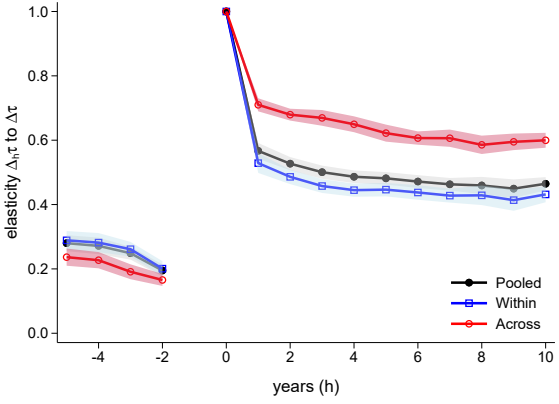
Transition frequencies (pct.)

		NNTR	NTR	PTA	UTPP
NNTR	*jg*	80.02	18.66	0.00	1.31
	j	89.37	9.22	0.00	1.41
NTR	*jg*	0.05	96.94	0.65	2.37
	j	0.33	88.65	0.18	10.85
PTA	*jg*	0.00	8.58	91.42	0.00
	j	0.00	0.00	100.00	0.00
UTPP	*jg*	0.01	16.63	0.94	82.42
	j	0.00	10.35	0.47	89.18

Across-regime tariff changes are more persistent

$$\Delta_h \tau_{jgt} = \beta_h^{\tau,W} \Delta_0 \tau_{jgt} \text{Within}_{jgt} + \beta_h^{\tau,A} \Delta_0 \tau_{jgt} \text{Across}_{jgt} + \delta_{jt} + \delta_{gt} + u_{jgt}$$

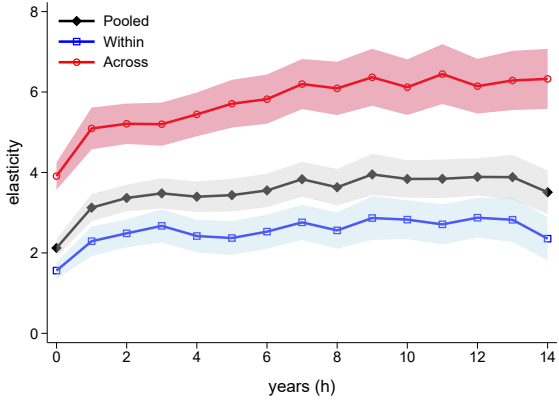
- Tariff-change autocorrelation, conditioning on regime switches
  - $\text{Within}_{jgt} = \mathbb{1}_{\{\text{regime}_{jgt} \neq \text{regime}_{jgt-1}\}}$
  - $\text{Across}_{jgt} = \mathbb{1}_{\{\text{regime}_{jgt} = \text{regime}_{jgt-1}\}}$
- δ_{gt}: common variation across countries, e.g. GATT rounds. Bigger differences when excluded.
- $\beta_h^{\tau,W} \approx$ pooled β_h^{τ} because sample mostly comprised of within-regime obs



Across-regime tariff changes have higher trade elasticities

$$\Delta_h v_{jgt} = -\beta_h^{v,W} \Delta_h \tau_{jgt} \text{Within}_{jgt} - \beta_h^{v,A} \Delta_h \tau_{jgt} \text{Across}_{jgt} + \delta_{jt} + \delta_{gt} + u_{jgt}.$$

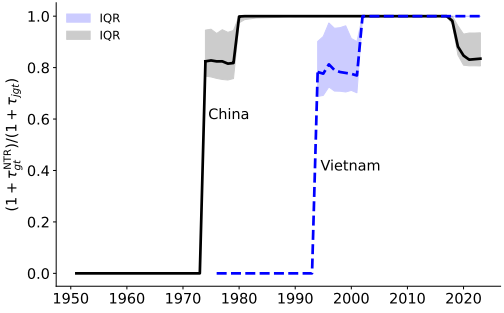
- DiD with $\Delta_h \tau_{jgt}$ instrumented by $\Delta_0 \tau_{jgt}$ (Boehm et al. 2023)
- δ_{jt}: bilateral exchange-rate movements, exporter business cycles
- δ_{gt}: good-specific demand shocks, multilateral policy changes
- Again, $\beta_h^{v,W} \approx$ pooled β_h^v
- Robust to other specifications (e.g. ECM), industry-j-t effects



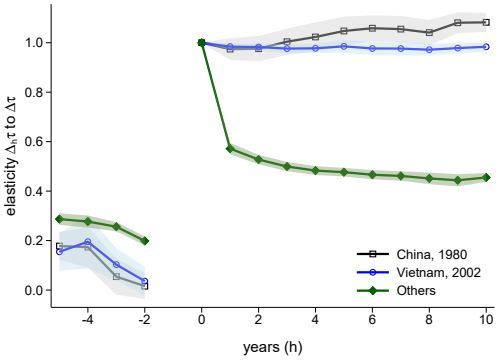
Approach #2: Case studies of China & Vietnam

- Same observed policy trajectory: embargo → NNTR → MFN
- Ex post, “most canonical” reforms in US trade history
- Ex ante, lots of uncertainty

Inverse tariffs (rel. MFN countries)



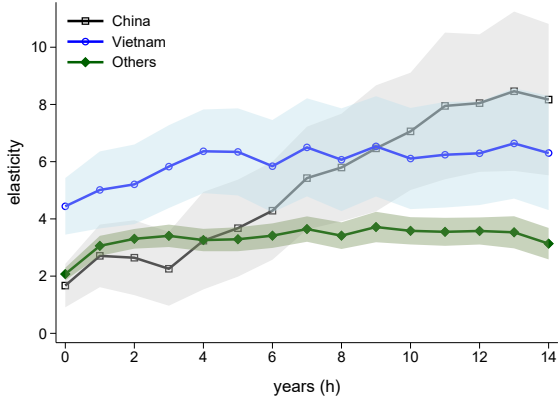
Tariff-change autocorrelation



CHN & VNM have higher trade elasticities than other countries

$$\Delta_h v_{jgt} = -\beta_h^{v,\text{CHN}} \Delta_h \tau_{jgt} \mathbb{1}_{\{j=\text{CHN}\}} - \beta_h^{v,\text{VNM}} \Delta_h \tau_{jgt} \mathbb{1}_{\{j=\text{VNM}\}} - \beta_h^{v,\text{OTH}} \Delta_h \tau_{jgt} \mathbb{1}_{\{j=\text{Other}\}} + \delta_{jt} + \delta_{gt} + u_{jgt}$$

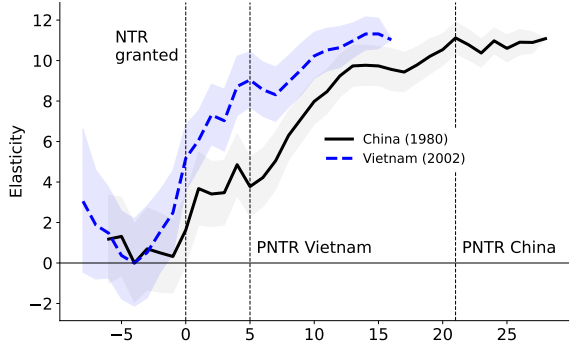
- Condition on countries instead of regime changes
- Includes all tariff changes for China and Vietnam, not just MFN grant
- Long run: CHN and VNM similar, larger than other countries (and also typical regime change)
- Short run: CHN similar to other countries but VNM higher (and similar to typical regime change)



Event-study to MFN access shows even higher elasticities

$$v_{jgt} = \sum_{t'=1974}^{2008} \beta_{\mathbf{t}}^{\mathbf{v},\mathrm{CHN}} \mathbb{1}_{\{t=t' \wedge j=\mathrm{CHN}\}} X_g + \sum_{t'=1994}^{2017} \beta_t^{v,\mathrm{VNM}} \mathbb{1}_{\{t=t' \wedge j=\mathrm{VNM}\}} X_g + \delta_{jt} + \delta_{jg} + \delta_{gt} + u_{jgt}.$$

- Elasticity of trade to gap between NNTR and MFN tariffs ("NNTR gap"):
  - $X_g = \log(1 + \tau_{g,1999}^{NNTR} - \tau_{g,1999}^{MFN})$
- Dual meaning: tariff reduction upon MFN access, but also exposure to risk of losing that access
- Similar LR elasticities, substantially larger than country averages and for average regime change
- Similar pre-MFN elasticities, but VNM's starts rising several years before MFN access



Roadmap

1. Empirical evidence
2. **Model + numerical experiments**
3. Calibration + recover structural elasticity

Overview of the model

- Partial equilibrium version of Alessandria, Choi and Ruhl 2021 (ACR 2021)
  - Slow adjustment due to exporter life-cycle, large gap between SR and LR response
  - Expectations about future trade policy, not current policy, drive export participation
- Firms
  - Heterogeneous in productivity (z), variable trade cost (ξ)
  - Die with probability $1-\delta$, replaced by new firm (fixed mass)
  - Pay sunk cost to export next period, smaller fixed cost to continue
  - New exporters start with low export capacity (ξ_H)
  - Longer tenure as exporter $\Rightarrow$ greater chance of low iceberg cost (ξ_L w.p. $1-\rho_\xi$)
- Trade policy
  - Allow for innovations to current tariffs (τ) and expectations about future tariffs ($\mathbb{E}\tau'$)
  - Exporting threshold depends on expected z, ξ and $\mathbb{E}\tau'$

Production, demand, static optimization

- Production technology (z = productivity; ℓ = labor):

$$y_t = z_t \ell_t$$

- Export demand curve (p_t = price; τ = tariff):

$$d_t(p_t, \tau_t) = (p_t \tau_t)^{-\theta}$$

- Resource constraint (ξ = variable trade cost):

$$y_t \geqslant \xi d_t(p_t, \tau_t)$$

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

$$\pi(z_t, \xi_t, \tau_t) = \max_{p,\, \ell} p d_t(p_t \tau_t) - w_t \ell_t \quad \textbf{s.t.} \quad z_t \ell_t \geqslant d_t(p_t, \tau_t) \xi_t$$

Exporter life cycle, dynamic optimization

- Variable trade cost (ξ) captures current export status
  - ∞: non-exporter
  - ξ_H: High iceberg (low-capacity) exporter
  - ξ_L: low iceberg (high-capacity) exporter
- Costs of exporting in $t+1$ depend on current export status in t
  - New exporters: pay f_0, start with low export capacity (ξ_H)
  - Continuing exporters: pay f_1, switch to higher/lower export capacity with prob. $1-\rho_\xi$
- Given z, ξ, τ, choose whether to export at $t+1$ to max PV of profits:

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

- Solution characterized by entry + exit thresholds that depend on z, ξ, and $\mathbb{E}\tau'$

Aggregation, trade elasticities

- Aggregate exports:

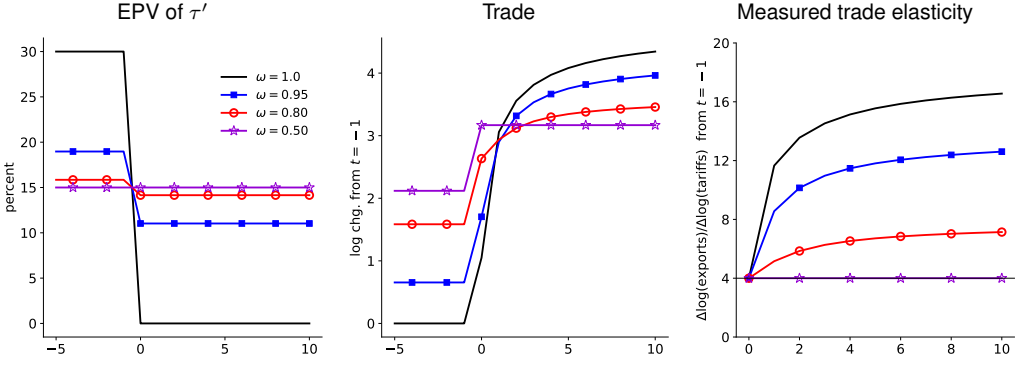
$$EX_t = \sum_{\xi \in \{\xi_L, \xi_H\}} \int_z p\left(z, \xi, \tau_t\right) d_t\left(z, \tau_t\right) \varphi_t\left(z, \xi\right) dz.$$

  - Per-firm sales (pd) depend on current tariffs
  - Distribution of productivity and export status (φ) depend on past and future tariffs

- Mapping to structural trade elasticities:
  - SR response to *unanticipated* reform: demand elasticity $= \theta$
  - LR response to *permanent* reform: $> \theta$, increasing in ξ_H/ξ_L and ρ_ξ

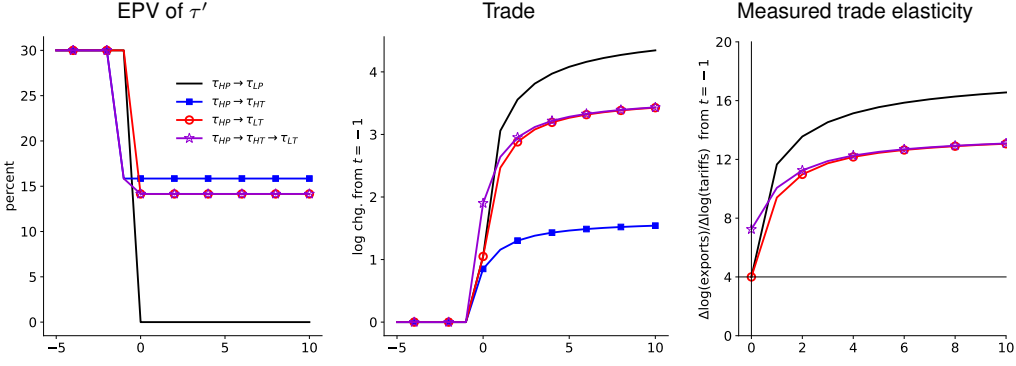
Experiment #1: persistent vs. transitory shocks

- Two-state Markov process: high vs. low tariffs, switching probability $1 - \omega$
- Start with τ_H for $= -\infty, \ldots, -1$, then switch to τ_L for $t = 0, \ldots, \infty$
- Compare canonical reform ($\omega = 1.0$) to less persistent reforms ($\omega \in \{0.95, 0.8, 0.5\}$)



Experiment #2: shocks to expectations

- Four-state Markov process: $[\tau_H, \tau_L] \times [\omega_P, \omega_T]$
- Four experiment variations:
  - $\tau_{HP} \to \tau_{LP}$: $\downarrow$ tariffs only
  - $\tau_{HP} \to \tau_{HT}$: $\downarrow$ persistence only
  - $\tau_{HP} \to \tau_{LT}$: simultaneous $\downarrow$ in tariffs and persistence in $t = 0$
  - $\tau_{HP} \to \tau_{HT} \to \tau_{LT}$: $\downarrow$ persistence in $t = -1$, then $\downarrow$ tariffs in $t = 0$



Experiment takeaways

- Transitory reforms have lower long-run trade elasticities
  - Post-reform trade suppressed by uncertainty about reform duration
  - Pre-reform trade boosted by expectation that reform could occur
- Anticipated reforms have higher short-run trade elasticities
  - Trade begins to react when expectations change, not just when tariffs change
- Reforms can be non-canonical in different ways
  - Across-regime tariff changes more canonical in sense of experiment #1, but less canonical in sense of experiment #2
  - China & Vietnam similar in sense of experiment #1, but Vietnam less canonical in sense of experiment #2

Roadmap

1. Empirical evidence
2. Model + numerical experiments
3. **Calibration + recover structural elasticity**

Overview of quantitative approach

- Leverage China & Vietnam case studies using Alessandria et al. (2025) methodology
- Model overview
  - Many goods $g = 1, \ldots, G$ with tariffs $\tau_{gt}(s)$ that depend on trade-policy state s
  - Two states: NNTR ($s = 0$) and MFN ($s = 1$)
  - Time-varying stochastic process $\{\omega_t(s, s')\}_{t=0}^{\infty}$
- Estimate trade technology to match modern-day steady state
  - Key input: exporter-level panel data
- Estimate ω_t to match transition from embargo
  - Key input: NNTR-gap elasticity
- Use calibrated model to conduct canonical reform, measure long-run trade elasticity

Step #1: Calibrate steady state to firm-level trade dynamics

- For each country, use firm-level panel data to compute facts about cross-sectional distribution and life-cycle dynamics of export participation
- Calibrate production & trade technologies so that PNTR steady state matches these facts

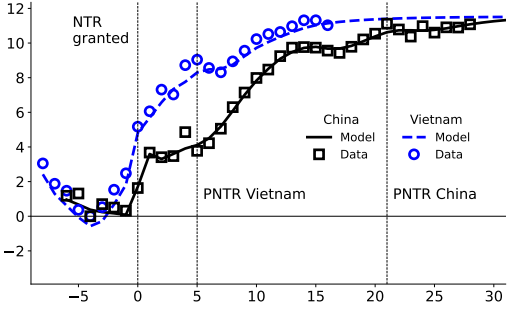
Country	Targets				Parameters			
	Export part. (%)	Exit rate (%)	Incumbent prem.	Log CV exports	f_0	f_1	ξ_H	σ_z
China	28	11	2.9	2.27	0.73	0.342	3.92	1.50
Vietnam	11	15	4.41	2.91	1.57	0.657	5.89	1.69

- Note: Assign demand elasticity θ externally based on Soderberry (2018) estimates
  - Reminder: $\theta =$ canonical SR elasticity
  - Same as measured SR elasticity in experiments, except with anticipation shocks
  - Works for China & Vietnam, even though latter has higher measured SR elasticity

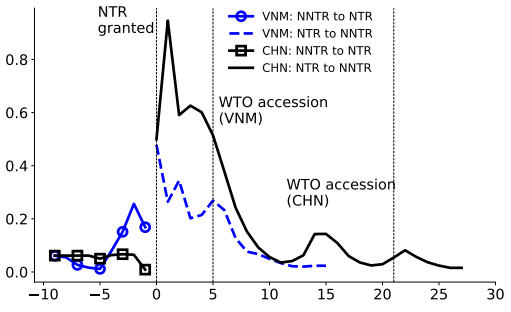
Step #2: Calibrate transition to aggregate trade dynamics

- Calibrate policy process to match elasticity of trade to NNTR gap
  - Pre-NTR dynamics identify $\omega_t(\mathit{NNTR}, \mathit{MFN})$
  - Post-NTR dynamics identify $\omega_t(\mathit{MFN}, \mathit{NNTR})$

NTR-gap elasticities

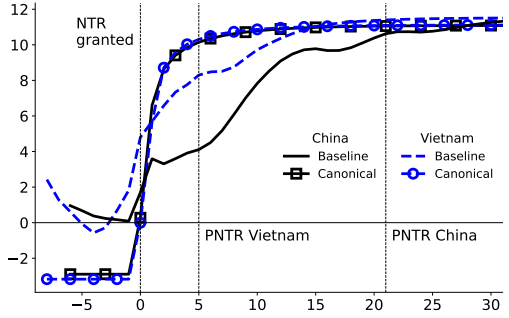


Estimated probabilities



Step #3: Measure canonical LR elasticities

- Start in NNTR steady state, then do unanticipated + permanent switch to NTR
- Measure canonical LR elasticity as SS-to-SS change in NNTR-gap elasticity
  - China: -14.0
  - Vietnam: -14.3
  - $\sim$25% larger than observed change in NNTR-gap elasticity



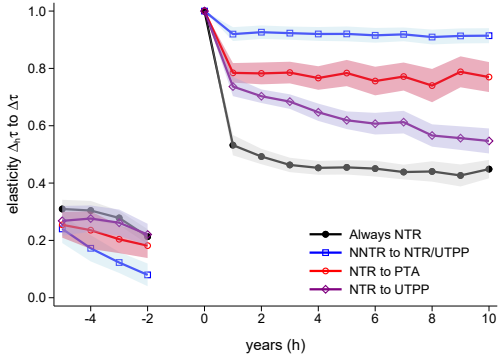
Summary & Conclusions

- Empirical evidence on more-canonical vs. less-canonical reforms
  - Most reforms occur within tariff regimes. Transitory, with low long-run trade elasticities.
  - Regime changes rare but more persistent. Higher long-run trade elasticities, but also higher short-run elasticities, likely due to anticipation.
  - Most canonical: China & Vietnam MFN access. Very high long-run trade elasticities. Differences in short run due to differences in anticipation.
- Recover canonical elasticity path using quantitative model
  - Estimate expectations for China & Vietnam by matching reduced-form evidence
  - Use calibrated model to conduct canonical reform. LR trade elasticity ≈ 14. Much larger than previously thought!
- Leveraging less canonical reforms more complicated, but also more interesting
  - Ambiguity about distribution of potential tariff changes, anticipation during negotiations, phased-in tariff changes, etc.

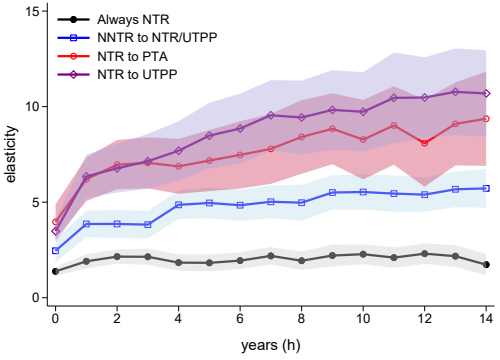
Appendix

Across vs. within regimes: detailed breakdown

Tariff autocorrelations

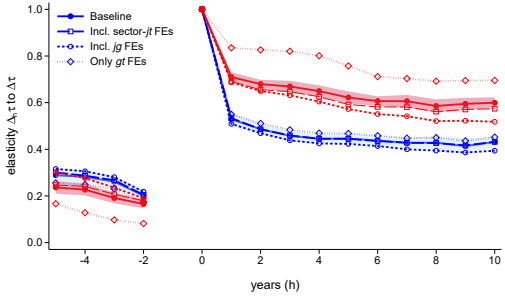


Reduced-form elasticities

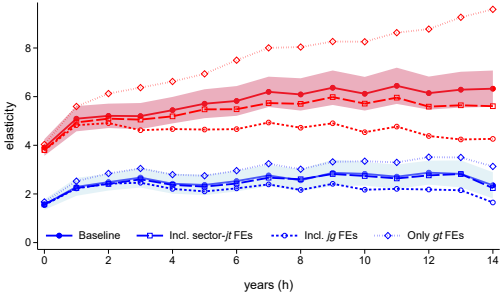


Across vs. within regimes: fixed effects

Tariff autocorrelations

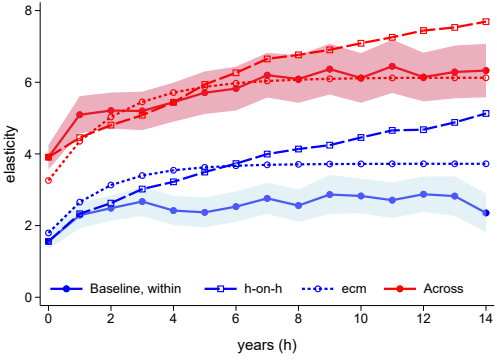


Reduced-form elasticities

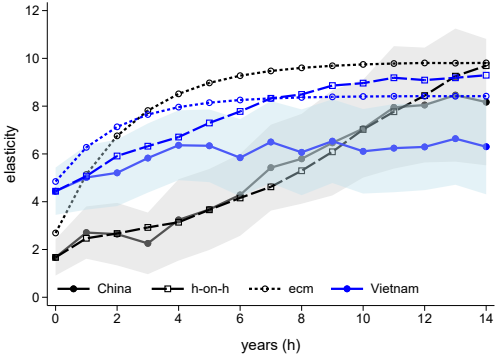


DiD vs. ECM

Across- vs. Within

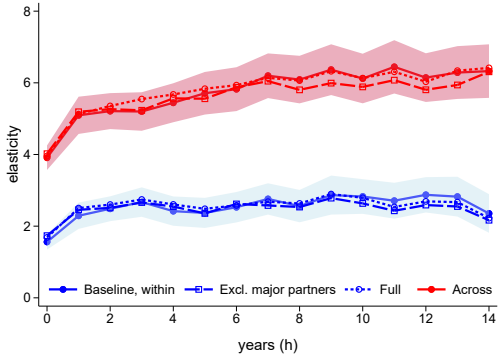


China & Vietnam

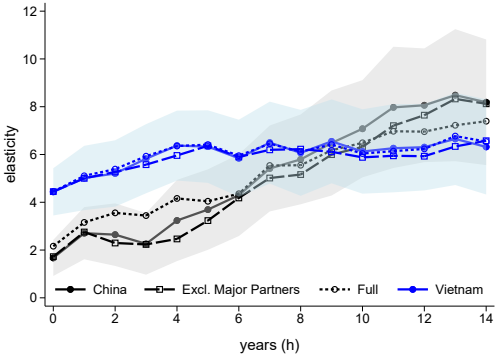


Sample design

(a) Across- vs. Within

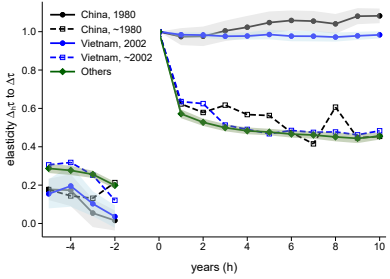


(b) China & Vietnam

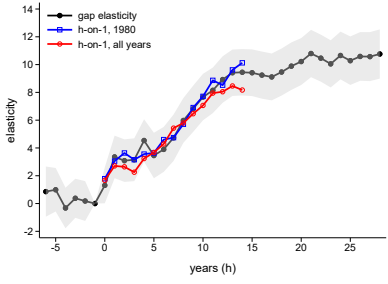


CHN & VNM: going from DiD to event study

Tariff autocorrelation



Elasticities: China



Elasticities: Vietnam