

Recovering Credible Trade Elasticities from Incredible Trade Reforms

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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 external 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

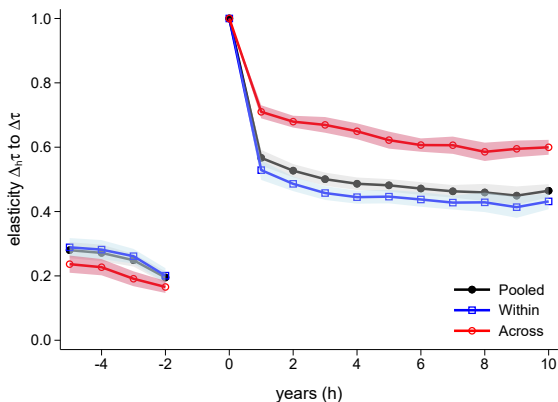
Tariff changes					
From	To	N # <i>jgt</i>	Mean (p.p.)	Median (p.p.)	Std. dev. (p.p.)
<i>(a) Within</i>					
NTR	NTR	1,352,360	-0.15	0.00	9.47
NNTR	NNTR	10,542	-0.25	0.00	9.25
PTA	PTA	75,910	-0.12	0.00	1.34
UTPP	UTPP	149,526	-0.03	0.00	1.04
<i>(b) Across</i>					
NNTR	NTR	1,523	-27.63	-26.17	24.04
NTR	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	<i>jj</i>	80.02	18.66	0.00	1.31
	<i>j</i>	89.37	9.22	0.00	1.41
NTR	<i>jj</i>	0.05	96.94	0.65	2.37
	<i>j</i>	0.33	88.65	0.18	10.85
PTA	<i>jj</i>	0.00	8.58	91.42	0.00
	<i>j</i>	0.00	0.00	100.00	0.00
UTPP	<i>jj</i>	0.01	16.63	0.94	82.42
	<i>j</i>	0.00	10.35	0.47	89.18

Across-regime tariff changes are more persistent

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

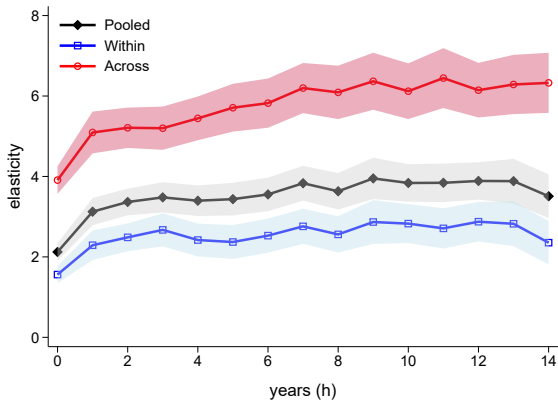
- ▶ Tariff-change autocorrelation, conditioning on regime switches
 - ▶ $\text{Within}_{jgt} = \mathbb{1}_{\{\text{regime}_{jgt} \neq \text{regime}_{jgt-1}\}}$
 - ▶ $\text{Across}_{jgt} = \mathbb{1}_{\{\text{regime}_{jgt} = \text{regime}_{jgt-1}\}}$
- ▶ δ_{gt} : common variation across countries, e.g. 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

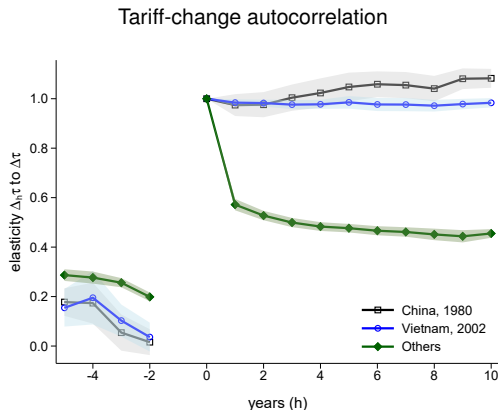
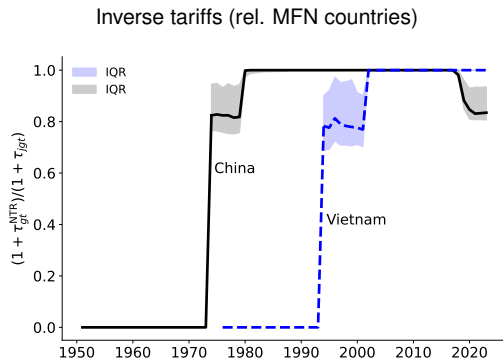
$$\Delta_h v_{jgt} = -\beta_h^{v,W} \Delta_h \tau_{jgt} \text{Within}_{jgt} - \beta_h^{v,A} \Delta_h \tau_{jgt} \text{Across}_{jgt} + \delta_{jt} + \delta_{gt} + u_{jgt}.$$

- ▶ 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

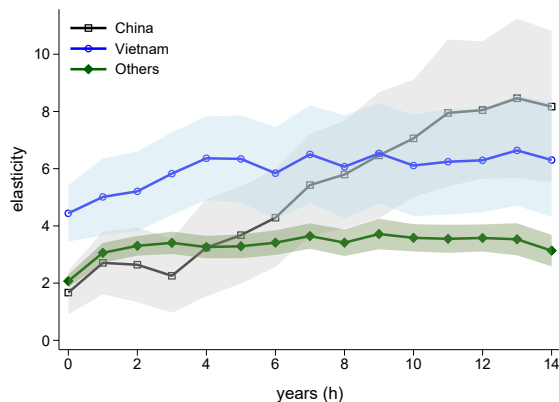
- ▶ Same observed policy trajectory: embargo → NNTR → MFN
- ▶ Ex post, “most canonical” reforms in US trade history
- ▶ Ex ante, lots of uncertainty



CHN & VNM have higher trade elasticities than other countries

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

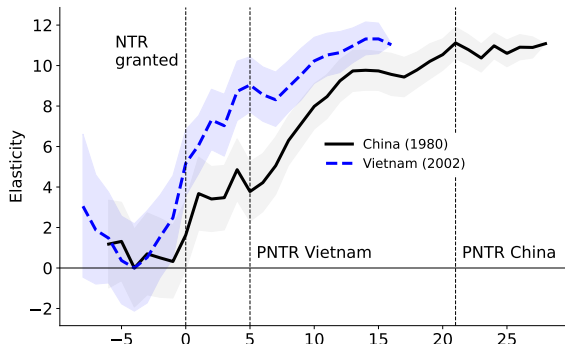
- ▶ Condition on countries instead of regime changes
- ▶ Includes all tariff changes for China and Vietnam, not just MFN grant
- ▶ Long run: CHN and VNM similar, larger than other countries (and also typical regime change)
- ▶ Short run: CHN similar to other countries but VNM higher (and similar to typical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



Event-study to MFN access shows even higher elasticities

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

- ▶ Elasticity of trade to gap between NNTR and MFN tariffs (“NNTR gap”):
 - ▶ $X_g = \log(1 + \tau_{g,1999}^{\text{NNTR}} - \tau_{g,1999}^{\text{MFN}})$
- ▶ 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):

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

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

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

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:

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

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

Aggregation, trade elasticities

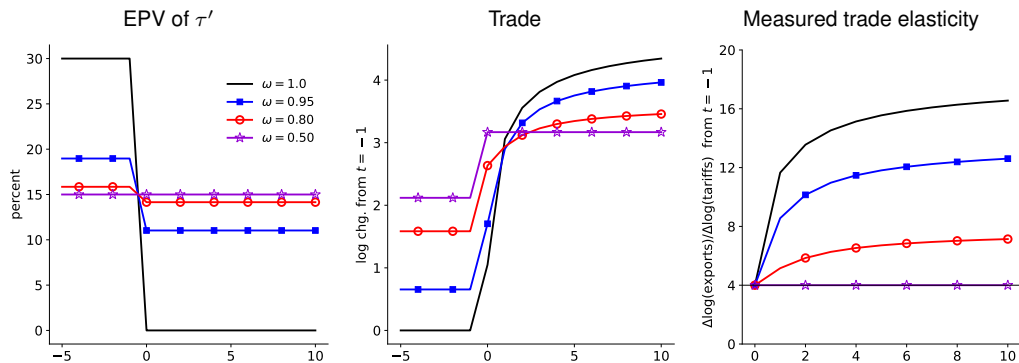
- ▶ Aggregate exports:

$$EX_t = \sum_{\xi \in \{\xi_L, \xi_H\}} \int_{\mathcal{Z}} p(z, \xi, \tau_t) d_t(z, \tau_t) \varphi_t(z, \xi) dz.$$

- ▶ 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 = θ
 - ▶ LR response to *permanent* reform: $> \theta$, increasing in ξ_H/ξ_L and ρ_ξ

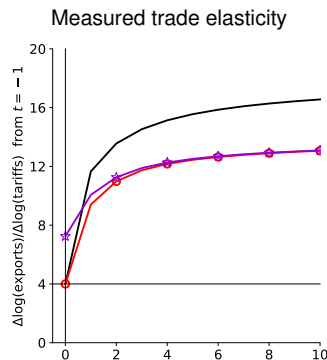
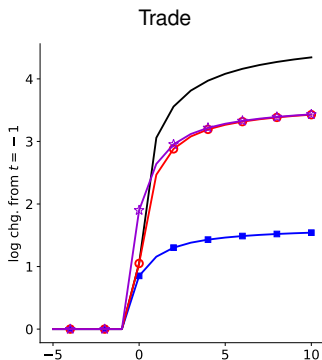
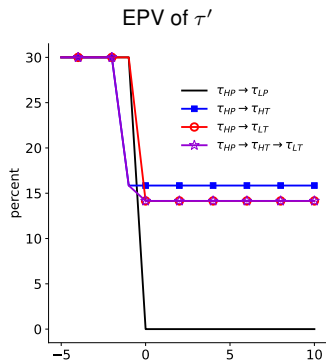
Experiment #1: persistent vs. transitory shocks

- ▶ Two-state Markov process: high vs. low tariffs, switching probability $1 - \omega$
- ▶ Start with τ_H for $= -\infty, \dots, -1$, then switch to τ_L for $t = 0, \dots, \infty$
- ▶ Compare canonical reform ($\omega = 1.0$) to less persistent reforms ($\omega \in \{0.95, 0.80, 0.5\}$)



Experiment #2: shocks to expectations

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

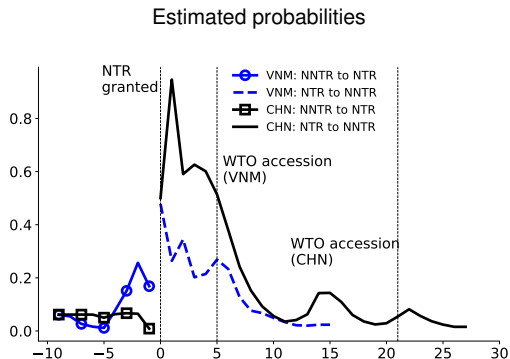
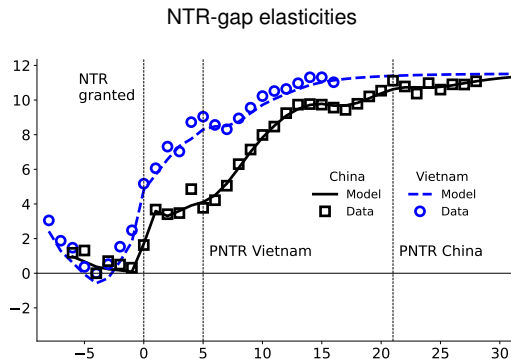
- ▶ For each country, use firm-level panel data to compute facts about cross-sectional distribution and life-cycle dynamics of export participation
- ▶ Calibrate production & trade technologies so that PNTR steady state matches these facts

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: θ = 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

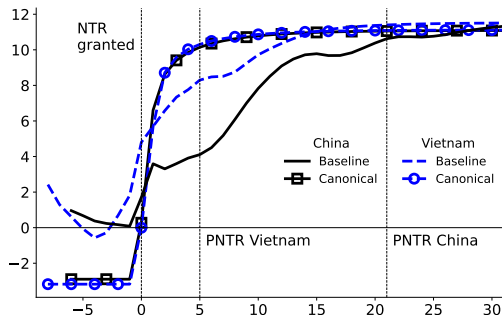
Step #2: Calibrate transition to aggregate trade dynamics

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



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
 - ▶ ~25% larger than observed change in NNTR-gap elasticity



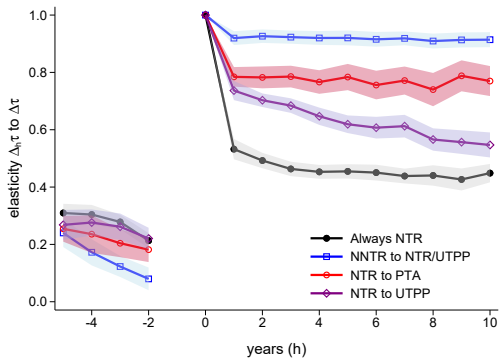
Summary & Conclusions

- ▶ 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.

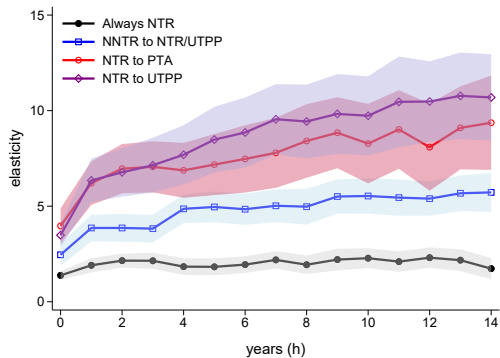
Appendix

Across vs. within regimes: detailed breakdown

Tariff autocorrelations

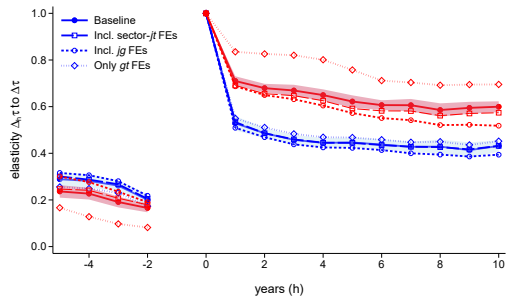


Reduced-form elasticities

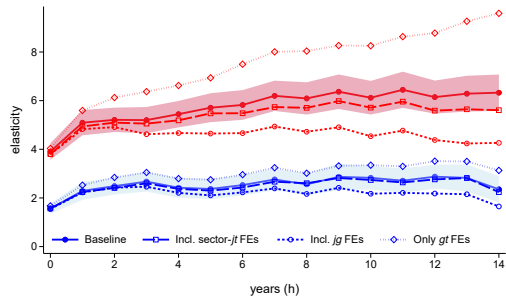


Across vs. within regimes: fixed effects

Tariff autocorrelations

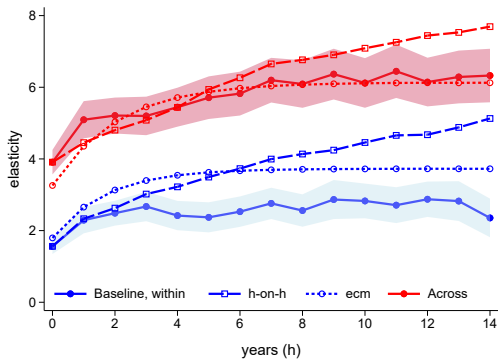


Reduced-form elasticities

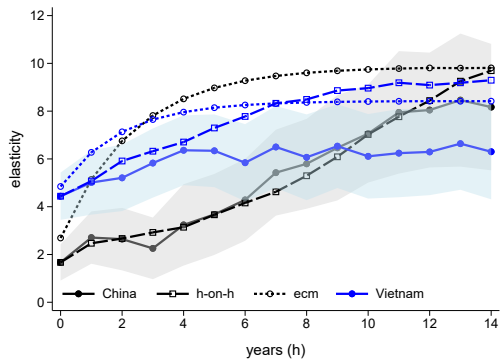


DiD vs. ECM

Across- vs. Within

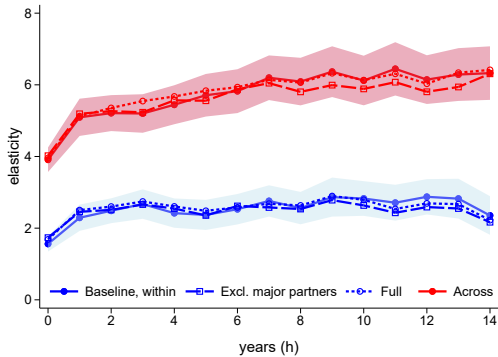


China & Vietnam

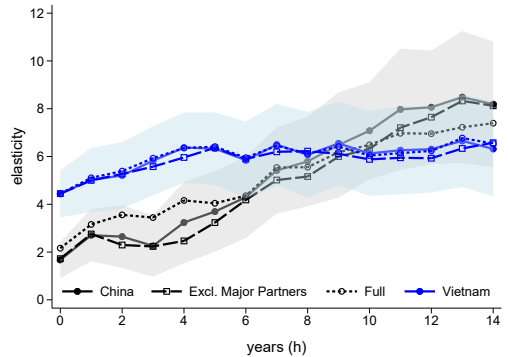


Sample design

(a) Across- vs. Within

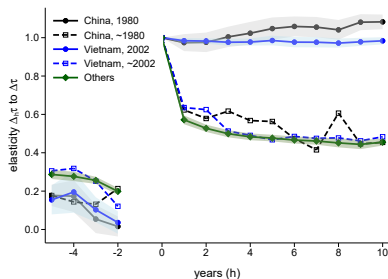


(b) China & Vietnam

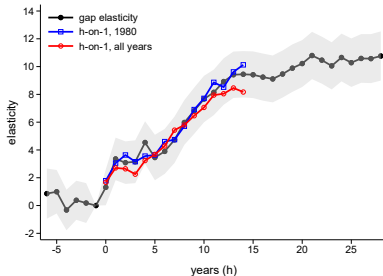


CHN & VNM: going from DiD to event study

Tariff autocorrelation



Elasticities: China



Elasticities: Vietnam

