

# Global Reallocations in the US-China Trade War

Pablo D. Fajgelbaum<sup>II◇</sup> Penny K. Goldberg<sup>‡◇</sup>  
Patrick J. Kennedy<sup>†</sup> Amit K. Khandelwal<sup>‡◇</sup> Daria Taglioni<sup>±</sup>

<sup>II</sup>UCLA, <sup>‡</sup>Yale, <sup>†</sup>Berkeley, <sup>±</sup>World Bank, <sup>◇</sup>NBER

June 2023

# Motivation

- In 2018-19, US-China engaged in a trade war, taxing \$450b of annual trade
  - ▶ thousands of goods tariffed, avg US tariffs from about 4% to 25%
  - ▶ US and China tariffs targeted 3.6% of US GDP and 5.5% of China GDP
- This paper: How are **bystanders'** exports affected?

# Motivation

- In 2018-19, US-China engaged in a trade war, taxing \$450b of annual trade
  - ▶ thousands of goods tariffed, avg US tariffs from about 4% to 25%
  - ▶ US and China tariffs targeted 3.6% of US GDP and 5.5% of China GDP
- This paper: How are **bystanders'** exports affected?
- Trade war is a natural experiment to understand the key forces driving world trade
  - ▶ Substitution/complementarities?
  - ▶ Scale?
  - ▶ Specialization?

# This Paper

- ① Framework to guide empirical analysis that captures these elements
- ② Estimate impacts of tariffs on bystanders' exports to US, CH, rest of world (RW)
- ③ Examine possible forces driving the responses

# This Paper

- ① Framework to guide empirical analysis that captures these elements
- ② Estimate impacts of tariffs on bystanders' exports to US, CH, rest of world (RW)
- ③ Examine possible forces driving the responses

## Method:

- model motivates product-level regressions to estimate impact of trade-war tariffs on countries' exports
- ...allowing for country-, sector-, and size-specific tariff responses

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities
- ③ Country component of tariff elasticities explains 80.5% of export growth variation
  - ▶ size and sector component of tariff elasticities account for rest



# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities
- ③ Country component of tariff elasticities explains 80.5% of export growth variation
  - ▶ size and sector component of tariff elasticities account for rest
- ④ Model reveals how to infer supply- and demand-forces driving country response
  - ▶ countries classified as complements or substitutes of US/China, and operating along upward or downward supply

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities
- ③ Country component of tariff elasticities explains 80.5% of export growth variation
  - ▶ size and sector component of tariff elasticities account for rest
- ④ Model reveals how to infer supply- and demand-forces driving country response
  - ▶ countries classified as complements or substitutes of US/China, and operating along upward or downward supply
  - ▶ MEX, TWN, COL, UKR operate along downward sloping supply

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities
- ③ Country component of tariff elasticities explains 80.5% of export growth variation
  - ▶ size and sector component of tariff elasticities account for rest
- ④ Model reveals how to infer supply- and demand-forces driving country response
  - ▶ countries classified as complements or substitutes of US/China, and operating along upward or downward supply
  - ▶ MEX, TWN, COL, UKR operate along downward sloping supply
    - ★ MEX, TWN: beneficiaries bc they substitute US and China

# Findings

- ① Bystanders increased exports to US, no change to CH, increased to RW
  - ▶ trade war created net trade opportunities, rather than re-shuffling trade across destinations
- ② Cross-country het. in export growth in tariffed products (relative to untaxed)
  - ▶ avg export growth in taxed products (relative to untaxed) is 6.5%, sd 6.1%
  - ▶ sd is just 1.4% under homogenous tariff elasticities
- ③ Country component of tariff elasticities explains 80.5% of export growth variation
  - ▶ size and sector component of tariff elasticities account for rest
- ④ Model reveals how to infer supply- and demand-forces driving country response
  - ▶ countries classified as complements or substitutes of US/China, and operating along upward or downward supply
  - ▶ MEX, TWN, COL, UKR operate along downward sloping supply
    - ★ MEX, TWN: beneficiaries bc they substitute US and China
    - ★ COL, UKR: not beneficiaries bc they complement US and China

# Related Literature

- Interdependency across export destinations
  - ▶ Morales et al 19, Alfaro et al 23, Alumnia et al 18, Mau 17, Flaaen et al 20, Albornoz et al 21
- Cross-country variation in trade elasticities
  - ▶ Anderson VW 03, Eaton Kortum 02, Costinot et al 12, Caliendo Parro 15, Adao et al 17, Lind Ramondo 18
- Scale economies
  - ▶ Antweiler Trefler 02, Costinot et al 19, Bartelme et al 19, Lashkaripir Lugovskyy 22
- US-China Trade War
  - ▶ Amiti et al. 19, Fajgelbaum et al. 20, Cavallo et al. 21, Flaaen et al. 20, Flaaen Pierce 19, Waugh 19

# Framework

- Ricardian-Armington trade model
- Translog aggregator of varieties (origins) of product  $\omega$  from sector  $j$  in country  $n$ :

$$s_{i\omega}^n = a_{i\omega}^n + \sum_{i' \in \mathcal{I}} \sigma_{i'i}^j \ln p_{i'\omega}^n$$

- ▶ with prices  $p_{i'\omega}^n = \tau_{i'\omega}^n T_{i\omega}^n p_{i'\omega}$
- ▶  $\sigma_{iCH}^j, \sigma_{iUS}^j$  capture  $i$ 's substitution with  $CH$  and  $US$
- ▶ assume  $\sigma_{ii'}^j = \sigma_{RW}^j$  for  $i' \neq i$  and  $i \neq US, CH$

# Framework

- Ricardian-Armington trade model
- Translog aggregator of varieties (origins) of product  $\omega$  from sector  $j$  in country  $n$ :

$$s_{i\omega}^n = a_{i\omega}^n + \sum_{i' \in \mathcal{I}} \sigma_{i'i}^j \ln p_{i'\omega}^n$$

- ▶ with prices  $p_{i'\omega}^n = \tau_{i'\omega}^n T_{i\omega}^n p_{i'\omega}$
  - ▶  $\sigma_{iCH}^j, \sigma_{iUS}^j$  capture  $i$ 's substitution with  $CH$  and  $US$
  - ▶ assume  $\sigma_{ii'}^j = \sigma_{RW}^j$  for  $i' \neq i$  and  $i \neq US, CH$
- Supply (sales) curve of exporter  $i$  of product  $\omega$ :

$$X_{i\omega} \equiv A_{ij} p_{i\omega}^{\frac{1}{b_i^j}} Z_{i\omega}$$

- ▶  $A_{ij}$ : endogenous sector ( $j$ )-level cost shifters (ie, wages, input costs)
  - ▶  $Z_{i\omega}$  exogenous cost shifter
  - ▶  $b_i^j = \frac{1}{\epsilon_i^j} - \gamma_i^j$ , where  $\epsilon_i^j$  reflects factor mobility &  $\gamma_i^j$  reflects scale
- Equilibrium: prices  $\{p_{i\omega}\}$  such that goods markets clear

# Impact of US-China Tariffs on Third-Country Exports

## Proposition

*Given tariff shocks  $\{T_{i\omega}^n\}$ , first-order approximation around an arbitrary initial equilibrium:*

$$\begin{aligned}\Delta \ln X_{i\omega}^n = & \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ & + \beta_{5i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{US} + \beta_{6i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{CH} + \eta_{i\omega}^n\end{aligned}$$



# Impact of US-China Tariffs on Third-Country Exports

## Proposition

Given tariff shocks  $\{T_{i\omega}^n\}$ , first-order approximation around an arbitrary initial equilibrium:

$$\begin{aligned}\Delta \ln X_{i\omega}^n = & \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ & + \beta_{5i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{US} + \beta_{6i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{CH} + \eta_{i\omega}^n\end{aligned}$$

- $\beta_{1i\omega}^n$  : tariff response to US tariff on China:

$$\beta_{1i\omega}^n \equiv \left( 1_{n=US} + \frac{E_{\omega}^{US}}{E_{\omega}} \frac{1}{\frac{X_{i\omega}/E_{\omega}}{b_i^j \sigma_{ii}^j} - 1} \right) \frac{\sigma_{CHi}^j}{s_{i\omega}^n}$$

- ▶ substitutability:  $\sigma_{CHi}^j$
- ▶ scale:  $b_i^j \sigma_{ii}^j$
- ▶ size:  $\frac{E_{\omega}^n}{E_{\omega}}$ ,  $\frac{X_{i\omega}}{E_{\omega}}$ ,  $\frac{X_{i\omega}^n}{E_{\omega}^n}$

# Impact of US-China Tariffs on Third-Country Exports

## Proposition

Given tariff shocks  $\{T_{i\omega}^n\}$ , first-order approximation around an arbitrary initial equilibrium:

$$\Delta \ln X_{i\omega}^n = \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ + \beta_{5i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{US} + \beta_{6i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{CH} + \eta_{i\omega}^n$$

- $\eta_{i\omega}^n$  : other goods prices, factor prices, aggregate demand shifts

$$\eta_{i\omega}^n = \frac{\left( \sum_{n' \in \mathcal{I}} \frac{x_{i\omega}^{n'}}{x_{i\omega}} \hat{E}_\omega^{n'} - \hat{A}_{ij} \right) b_{ii}^j \sigma_{ii}^j + \sum_{i' = US, CH} \sigma_{CHi}^j \hat{p}_{i'\omega} + \sigma_{RW}^j \sum_{i' \neq i} \hat{p}_{i'\omega}}{1 - \frac{\sigma_{ii}^j b_{ii}^j}{x_{i\omega} / E_\omega}} \frac{1}{s_{i\omega}^n} + \hat{E}_\omega^n$$

- vanishes with
  - ★ Cobb-Douglas product-level shifters
  - ★  $\rightarrow 0$  price changes in US and China
  - ★  $\rightarrow 0$  cross-substitutions ( $\sigma_{RW}^j = 0$ )
- implementation: exporter-importer-sector FEs, size controls, assess pre-trends

# Impact of US-China Tariffs on Third-Country Exports

## Proposition

Given tariff shocks  $\{T_{i\omega}^n\}$ , first-order approximation around an arbitrary initial equilibrium:

$$\Delta \ln X_{i\omega}^n = \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ + \beta_{5i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{US} + \beta_{6i\omega}^n \sum_{j \neq CH, US, i} \Delta \ln T_{j,\omega}^{CH} + \eta_{i\omega}^n$$

- $\eta_{i\omega}^n$  : other goods prices, factor prices, aggregate demand shifts

$$\eta_{i\omega}^n = \frac{\left( \sum_{n' \in \mathcal{I}} \frac{x_{i\omega}^{n'}}{x_{i\omega}} \hat{E}_\omega^{n'} - \hat{A}_{ij} \right) b_{ii}^j \sigma_{ii}^j + \sum_{i' = US, CH} \sigma_{CHi}^j \hat{p}_{i'\omega} + \sigma_{RW}^j \sum_{i' \neq i} \hat{p}_{i'\omega}}{1 - \frac{\sigma_{ii}^j b_{ii}^j}{x_{i\omega} / E_\omega}} \frac{1}{s_{i\omega}^n} + \hat{E}_\omega^n$$

- ▶ vanishes with

- ★ Cobb-Douglas product-level shifters
- ★  $\rightarrow 0$  price changes in US and China
- ★  $\rightarrow 0$  cross-substitutions ( $\sigma_{RW}^j = 0$ )

- ▶ implementation: exporter-importer-sector FEs, size controls, assess pre-trends

- Set  $\beta_5 = \beta_6 = 0$  because of lack of tariff variation

# Parameter Regions Implied by Export Responses

## Proposition

When the US imposes a tariff on China in product  $\omega$ , then:

- (i) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ), exports from  $i$  to the US generally increase (decrease)
- (ii) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ) and  $\sigma_{ii} < 0$ , exports increase (decrease) from  $i$  to RW iff  $\frac{X_{i\omega}/E_{\omega}}{\sigma_{ii}} < b_i < 0$ .

	Exports:	
	Decrease to US ( $\beta_{1i\omega}^{US} < 0$ )	Increase to US ( $\beta_{1i\omega}^{US} > 0$ )
Increase to RW ( $\beta_{1i\omega}^{RW} > 0$ )		
Decrease to RW ( $\beta_{1i\omega}^{RW} < 0$ )		

# Parameter Regions Implied by Export Responses

## Proposition

When the US imposes a tariff on China in product  $\omega$ , then:

- (i) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ), exports from  $i$  to the US generally increase (decrease)
- (ii) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ) and  $\sigma_{ii} < 0$ , exports increase (decrease) from  $i$  to RW iff  $\frac{X_{i\omega}/E_{\omega}}{\sigma_{ii}} < b_i < 0$ .

	Exports:	
	Decrease to US ( $\beta_{1i\omega}^{US} < 0$ )	Increase to US ( $\beta_{1i\omega}^{US} > 0$ )
Increase to RW ( $\beta_{1i\omega}^{RW} > 0$ )		China substitute ( $\sigma_{CHi} > 0$ )
Decrease to RW ( $\beta_{1i\omega}^{RW} < 0$ )		China substitute ( $\sigma_{CHi} > 0$ )

# Parameter Regions Implied by Export Responses

## Proposition

When the US imposes a tariff on China in product  $\omega$ , then:

- (i) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ), exports from  $i$  to the US generally increase (decrease)
- (ii) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ) and  $\sigma_{ii} < 0$ , exports increase (decrease) from  $i$  to RW iff  $\frac{X_{i\omega}/E_{\omega}}{\sigma_{ii}} < b_i < 0$ .

	Exports:	
	Decrease to US ( $\beta_{1i\omega}^{US} < 0$ )	Increase to US ( $\beta_{1i\omega}^{US} > 0$ )
Increase to RW ( $\beta_{1i\omega}^{RW} > 0$ )		China substitute ( $\sigma_{CHi} > 0$ ) neg sloping supply ( $b_i < 0$ )
Decrease to RW ( $\beta_{1i\omega}^{RW} < 0$ )		China substitute ( $\sigma_{CHi} > 0$ ) pos sloping supply ( $b_i > 0$ )

# Parameter Regions Implied by Export Responses

## Proposition

When the US imposes a tariff on China in product  $\omega$ , then:

- (i) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ), exports from  $i$  to the US generally increase (decrease)
- (ii) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ) and  $\sigma_{ii} < 0$ , exports increase (decrease) from  $i$  to RW iff  $\frac{X_{i\omega}/E_{\omega}}{\sigma_{ii}} < b_i < 0$ .

	Exports:	
	Decrease to US ( $\beta_{1i\omega}^{US} < 0$ )	Increase to US ( $\beta_{1i\omega}^{US} > 0$ )
Increase to RW ( $\beta_{1i\omega}^{RW} > 0$ )	China complement ( $\sigma_{CHi} < 0$ ) pos sloping supply ( $b_i > 0$ )	China substitute ( $\sigma_{CHi} > 0$ ) neg sloping supply ( $b_i < 0$ )
Decrease to RW ( $\beta_{1i\omega}^{RW} < 0$ )	China complement ( $\sigma_{CHi} < 0$ ) neg sloping supply ( $b_i < 0$ )	China substitute ( $\sigma_{CHi} > 0$ ) pos sloping supply ( $b_i > 0$ )

# Parameter Regions Implied by Export Responses

## Proposition

When the US imposes a tariff on China in product  $\omega$ , then:

- (i) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ), exports from  $i$  to the US generally increase (decrease)
- (ii) if  $\sigma_{CHi} > 0$  ( $\sigma_{CHi} < 0$ ) and  $\sigma_{ii} < 0$ , exports increase (decrease) from  $i$  to RW iff  $\frac{X_{i\omega}/E_{\omega}}{\sigma_{ii}} < b_i < 0$ .

	Exports:	
	Decrease to US ( $\beta_{1i\omega}^{US} < 0$ )	Increase to US ( $\beta_{1i\omega}^{US} > 0$ )
Increase to RW ( $\beta_{1i\omega}^{RW} > 0$ )	China complement ( $\sigma_{CHi} < 0$ ) pos sloping supply ( $b_i > 0$ )	China substitute ( $\sigma_{CHi} > 0$ ) neg sloping supply ( $b_i < 0$ )
Decrease to RW ( $\beta_{1i\omega}^{RW} < 0$ )	China complement ( $\sigma_{CHi} < 0$ ) neg sloping supply ( $b_i < 0$ )	China substitute ( $\sigma_{CHi} > 0$ ) pos sloping supply ( $b_i > 0$ )

- Same logic applies to Chinese tariffs on US
  - In that case, sign of  $\sigma_{USi}$  is revealed



# Data

- Global bilateral trade data, 2014:1–2019:12 Comtrade
  - ▶ Top 50 countries, 95.9% of world trade
  - ▶ US, CH, RW as destinations

# Data

- Global bilateral trade data, 2014:1–2019:12 Comtrade
  - ▶ Top 50 countries, 95.9% of world trade
  - ▶ US, CH, RW as destinations
- Statutory tariff schedules, 2018:1–2019:12
  - ▶  $\Delta T_{CH,\omega}^{US}$ : US tariff changes on China in product  $\omega$  US ITC
  - ▶  $\Delta T_{i,\omega}^{US}$ : US tariffs changes on exporter  $i$  US ITC
  - ▶  $\Delta T_{US,\omega}^{CH}$ : China tariffs changes on US China MoF
  - ▶  $\Delta T_{i,\omega}^{CH}$ : China MFN tariffs (ex USA) Bown et al. 2019

# Data

- Global bilateral trade data, 2014:1–2019:12 Comtrade
  - ▶ Top 50 countries, 95.9% of world trade
  - ▶ US, CH, RW as destinations
- Statutory tariff schedules, 2018:1–2019:12
  - ▶  $\Delta T_{CH,\omega}^{US}$ : US tariff changes on China in product  $\omega$  US ITC
  - ▶  $\Delta T_{i,\omega}^{US}$ : US tariffs changes on exporter  $i$  US ITC
  - ▶  $\Delta T_{US,\omega}^{CH}$ : China tariffs changes on US China MoF
  - ▶  $\Delta T_{i,\omega}^{CH}$ : China MFN tariffs (ex USA) Bown et al. 2019
- Definitions
  - ▶  $i$ : exporter
  - ▶  $\omega$ : products (hs6)
  - ▶  $j$ : 9 sectors
  - ▶  $\Delta \ln X_{CH\omega}^{US}$ : exports from CH to US

# Data

- Global bilateral trade data, 2014:1–2019:12 Comtrade
  - ▶ Top 50 countries, 95.9% of world trade
  - ▶ US, CH, RW as destinations
- Statutory tariff schedules, 2018:1–2019:12
  - ▶  $\Delta T_{CH,\omega}^{US}$ : US tariff changes on China in product  $\omega$  US ITC
  - ▶  $\Delta T_{i,\omega}^{US}$ : US tariffs changes on exporter  $i$  US ITC
  - ▶  $\Delta T_{US,\omega}^{CH}$ : China tariffs changes on US China MoF
  - ▶  $\Delta T_{i,\omega}^{CH}$ : China MFN tariffs (ex USA) Bown et al. 2019
- Definitions
  - ▶  $i$ : exporter
  - ▶  $\omega$ : products (hs6)
  - ▶  $j$ : 9 sectors
  - ▶  $\Delta \ln X_{CH\omega}^{US}$ : exports from CH to US
- Aggregate data to 24-month periods, study long differences
  - ▶ Examine 2016/17 to 2018/19 export growth in response to tariffs
  - ▶ Scale tariffs in proportion to their duration through the 24-month interval

# Summary Statistics: World Trade in 2017

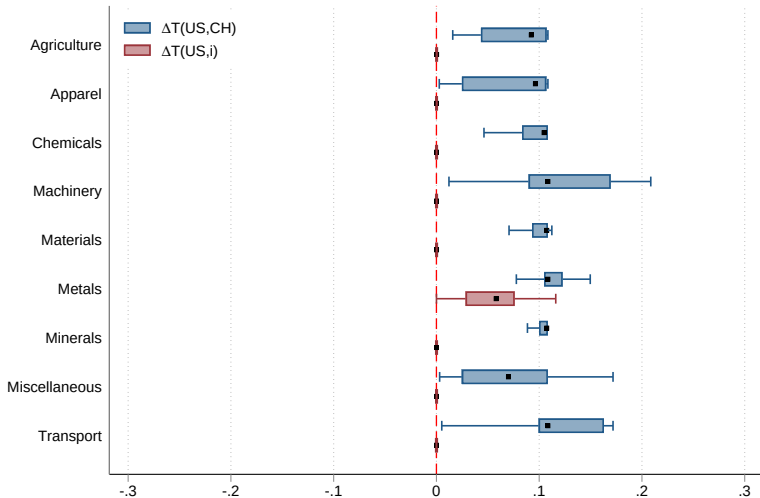
Industry	Examples	USD	Share	# HS6	Share
Machinery	Engines, computers, cell phones	5,632	0.30	771	0.15
Materials	Plastics, lumber, stones, glass	2,246	0.12	639	0.12
Transport	Vehicles, airplanes, parts	2,121	0.11	130	0.02
Chemicals	Medications, cosmetics, vaccines	1,884	0.10	787	0.15
Agriculture	Soy beans, wine, coffee, beef	1,617	0.09	899	0.17
Minerals	Oil, coal, salt, electricity	1,586	0.08	148	0.03
Metals	Copper, steel, iron, aluminum	1,350	0.07	563	0.11
Apparel	Footwear, t-shirts, hand bags	1,100	0.06	912	0.18
Miscellaneous	Medical devices, furniture, art	1,255	0.07	354	0.07

- 5203 HS6 products classified into 9 sectors

► specialization

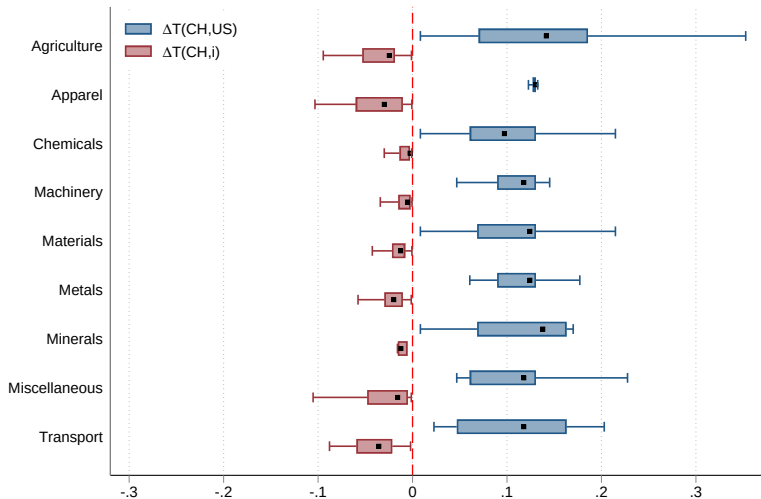
# US Tariff Changes

$\Delta T_{CH}^{US}$  &  $\Delta T_i^{US}$



# China Tariff Changes

$\Delta T_{US}^{CH}$  &  $\Delta T_i^{CH}$

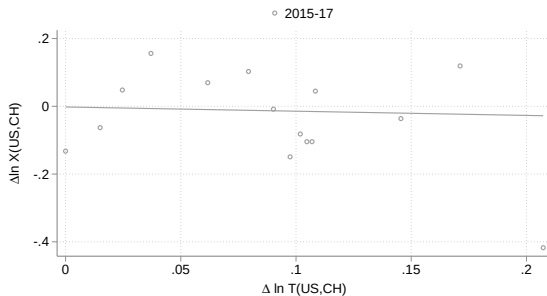


# China Exports to US on $\Delta T_{CH}^{US}$

China's exports to US fall with US tariff

$$\Delta X_{CH\omega}^{US} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{CH\omega}^{US}$$

**Panel A**  
China's Export Value to US



Pre-period:  $\beta = -0.12$  (0.29).

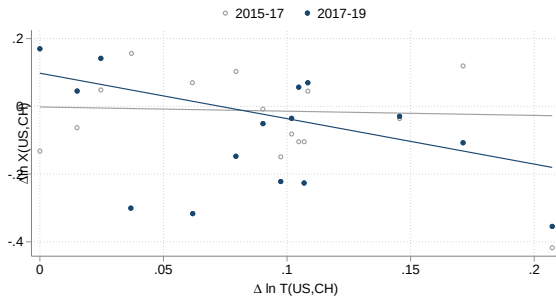


# China Exports to US on $\Delta T_{CH}^{US}$

China's exports to US fall with US tariff

$$\Delta X_{CH\omega}^{US} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{CH\omega}^{US}$$

**Panel A**  
China's Export Value to US



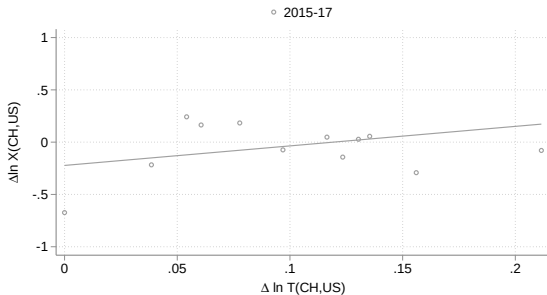
Pre-period:  $\beta = -0.12$  (0.29). Post-period:  $\beta = -1.34$  (0.27).

# US Exports to China on $\Delta T_{US}^{CH}$

US exports to CH fall with CH tariff

$$\Delta X_{US\omega}^{CH} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{US\omega}^{CH}$$

**Panel B**  
US Export Value to China



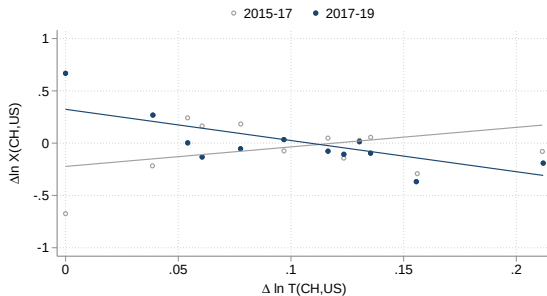
Pre-period:  $\beta=1.87$  (0.46).

# US Exports to China on $\Delta T_{US}^{CH}$

US exports to CH fall with CH tariff

$$\Delta X_{US\omega}^{CH} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{US\omega}^{CH}$$

**Panel B**  
US Export Value to China



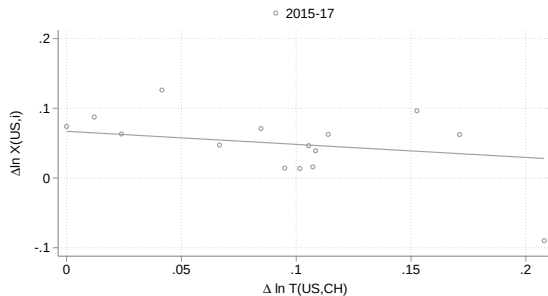
Pre-period:  $\beta=1.87$  (0.46). Post-period:  $\beta=-2.98$  (0.42).

# RW Exports to US on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to US increase with US tariff

$$\Delta X_{RW\omega}^{US} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{US}$$

**Panel A**  
Bystanders' Export Value to US

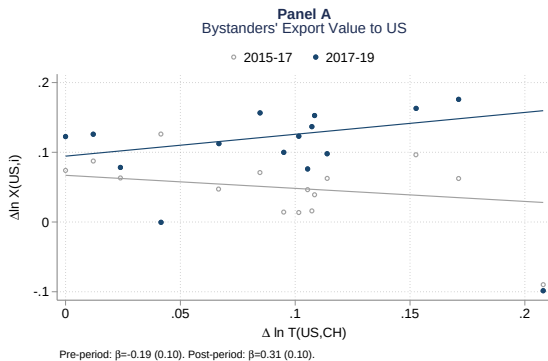


Pre-period:  $\beta = -0.19$  (0.10).

# RW Exports to US on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to US increase with US tariff

$$\Delta X_{RW\omega}^{US} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{US}$$

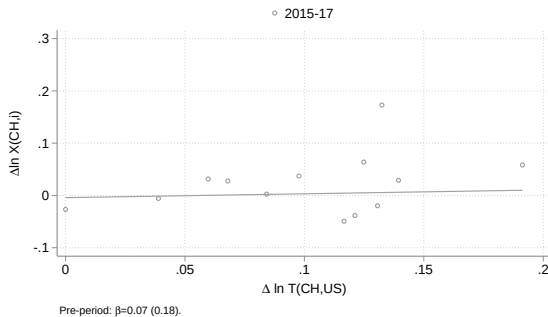


# RW Exports to CH on $\Delta T_{US}^{CH}$

Takeaway 1: RW exports to CH flat with CH tariff

$$\Delta X_{RW\omega}^{CH} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{CH}$$

**Panel B**  
Bystanders' Export Value to China

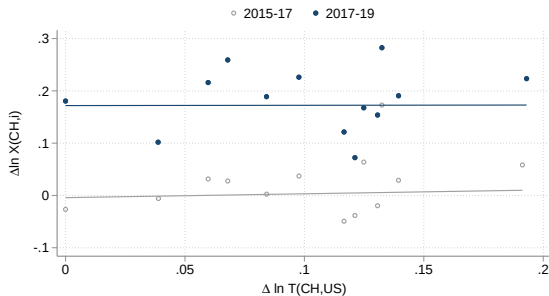


# RW Exports to CH on $\Delta T_{US}^{CH}$

Takeaway 1: RW exports to CH flat with CH tariff

$$\Delta X_{RW\omega}^{CH} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{CH}$$

**Panel B**  
Bystanders' Export Value to China

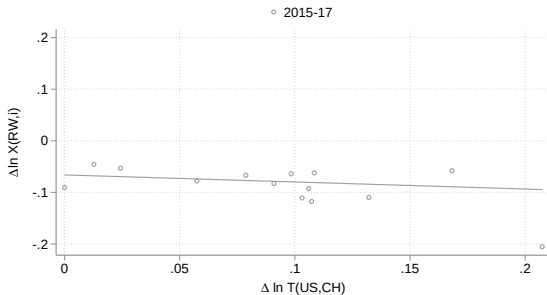


# RW Exports to RW on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to RW increase with US tariff

$$\Delta X_{RW\omega}^{RW} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{RW}$$

**Panel C**  
Bystanders' Export Value to RW



Pre-period:  $\beta = -0.14$  (0.08).

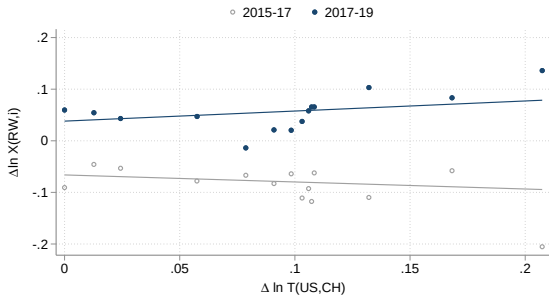


# RW Exports to RW on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to RW increase with US tariff

$$\Delta X_{RW\omega}^{RW} = \alpha + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{RW}$$

**Panel C**  
Bystanders' Export Value to RW



Pre-period:  $\beta = -0.14$  (0.08). Post-period:  $\beta = 0.20$  (0.08).

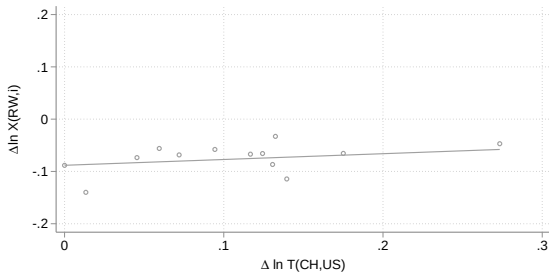
# RW Exports to RW on $\Delta T_{US}^{CH}$

Takeaway 1: RW exports to RW increase with CH tariff

$$\Delta X_{RW\omega}^{RW} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{RW}$$

**Panel D**  
Bystanders' Export Value to RW

◦ 2015-17



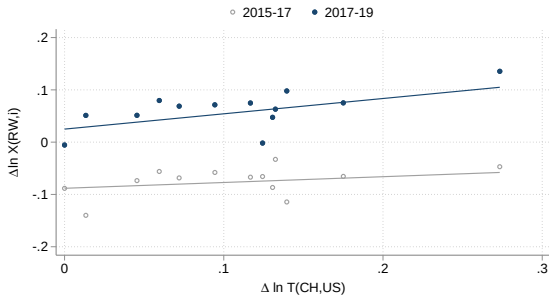
Pre-period:  $\beta=0.11$  (0.08).

# RW Exports to RW on $\Delta T_{US}^{CH}$

Takeaway 1: RW exports to RW increase with CH tariff

$$\Delta X_{RW\omega}^{RW} = \alpha + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{RW}$$

**Panel D**  
Bystanders' Export Value to RW



Pre-period:  $\beta=0.11$  (0.08). Post-period:  $\beta=0.29$  (0.08).

# Main Specification

- Full specification:

$$\Delta \ln X_{i\omega}^n = \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ + \alpha_{ij}^n + \Omega^n SIZE_{i\omega} + \pi^n \Delta \ln X_{i\omega,t-1}^n + \epsilon_{i\omega}^n,$$

- ▶  $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{zj(\omega)}^n + \Gamma_z^n SIZE_{zi\omega} \quad z = 1, 2, 3, 4$
- ▶ run separately to destinations  $n = US, CH, RW$
- ▶ country-sector fixed effects, lagged growth controls for pretrends

# Main Specification

- Full specification:

$$\Delta \ln X_{i\omega}^n = \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ + \alpha_{ij}^n + \Omega^n SIZE_{i\omega} + \pi^n \Delta \ln X_{i\omega,t-1}^n + \epsilon_{i\omega}^n,$$

- ▶  $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{zj(\omega)}^n + \Gamma_z^n SIZE_{zi\omega} \quad z = 1, 2, 3, 4$
- ▶ run separately to destinations  $n = US, CH, RW$
- ▶ country-sector fixed effects, lagged growth controls for pretrends
- ▶  $SIZE_{zi\omega}$  contains three proxies:
  - ★ share US (or CH) imports in global imports in  $\omega$
  - ★ share of exporter  $i$  exports in global imports in  $\omega$
  - ★ share of variety  $i\omega$  in destination  $n$  imports

# Main Specification

- Full specification:

$$\Delta \ln X_{i\omega}^n = \beta_{1i\omega}^n \Delta \ln T_{CH,\omega}^{US} + \beta_{2i\omega}^n \Delta \ln T_{US,\omega}^{CH} + \beta_{3i\omega}^n \Delta \ln T_{i,\omega}^{US} + \beta_{4i\omega}^n \Delta \ln T_{i,\omega}^{CH} \\ + \alpha_{ij}^n + \Omega^n SIZE_{i\omega} + \pi^n \Delta \ln X_{i\omega,t-1}^n + \epsilon_{i\omega}^n,$$

- ▶  $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{zj(\omega)}^n + \Gamma_z^n SIZE_{zi\omega} \quad z = 1, 2, 3, 4$
- ▶ run separately to destinations  $n = US, CH, RW$
- ▶ country-sector fixed effects, lagged growth controls for pretrends
- ▶  $SIZE_{zi\omega}$  contains three proxies:
  - ★ share US (or CH) imports in global imports in  $\omega$
  - ★ share of exporter  $i$  exports in global imports in  $\omega$
  - ★ share of variety  $i\omega$  in destination  $n$  imports

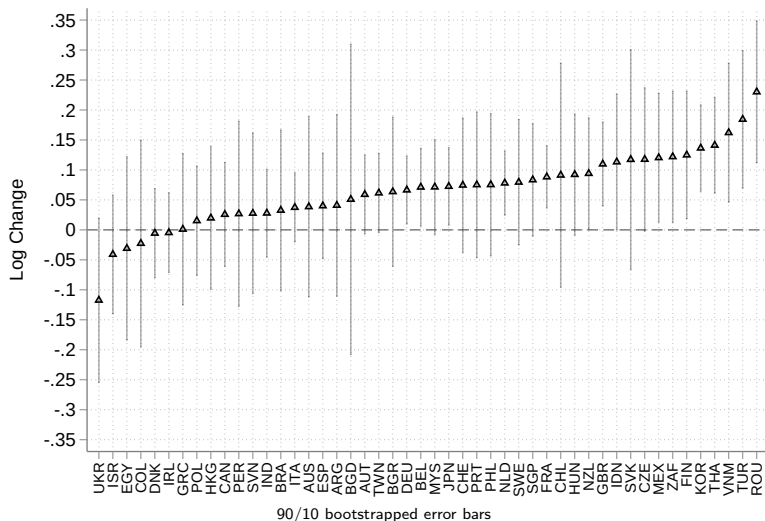
- Predicted values:

$$\Delta \widehat{\ln X_i^{WD}} = \sum_{\omega} \sum_n \lambda_{i\omega}^n \left( \widehat{\beta_{1i\omega}^n} \Delta \ln T_{CH,\omega}^{US} + \widehat{\beta_{2i\omega}^n} \Delta \ln T_{US,\omega}^{CH} + \widehat{\beta_{3i\omega}^n} \ln T_{i,\omega}^{US} + \widehat{\beta_{4i\omega}^n} \Delta \ln T_{i,\omega}^{CH} \right)$$

- ▶  $\lambda_{i\omega}^n$  pre-war export shares of variety  $i\omega$  in total exports of  $i$  to  $n$

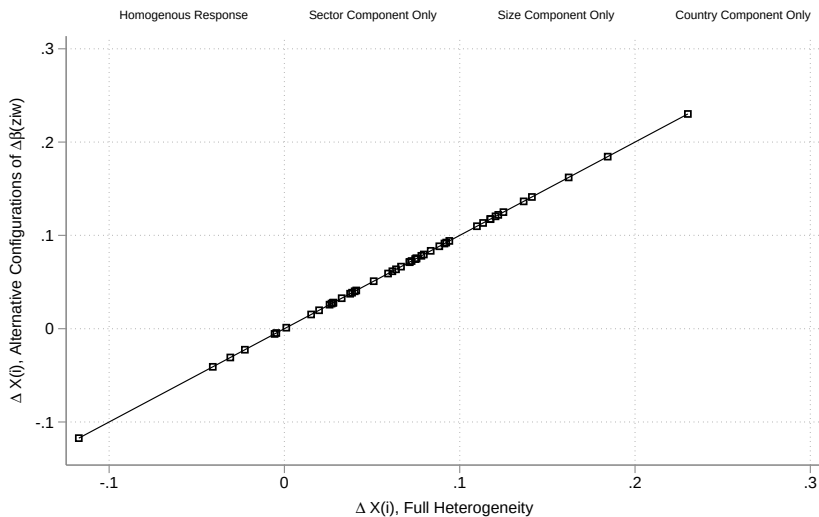
# Relative Export Growth in Targeted Products

Takeaway 2: Large Heterogeneity in Predicted Exporter Growth



# Decomposing Relative Exports, $\beta_{ziw}^n = \beta_{zi}^n + \beta_{zj(w)}^n + \Gamma_z^n SIZE_{ziw}$

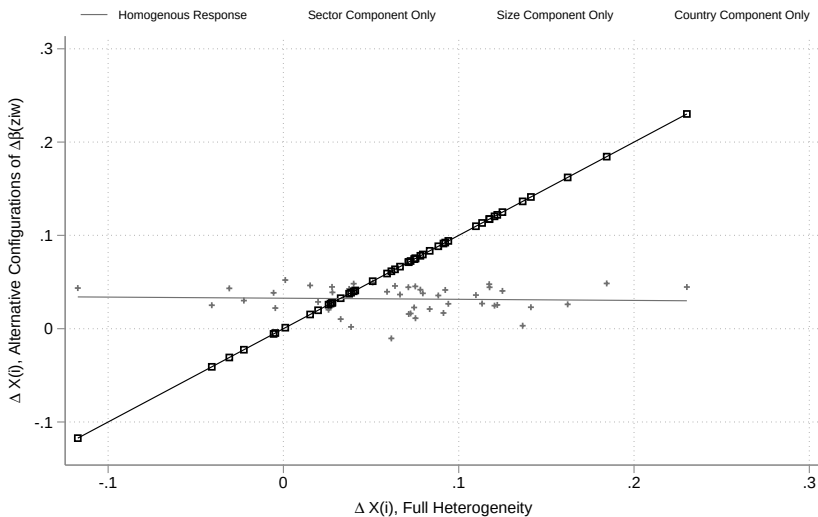
Takeaway 3: Importance of Country Component





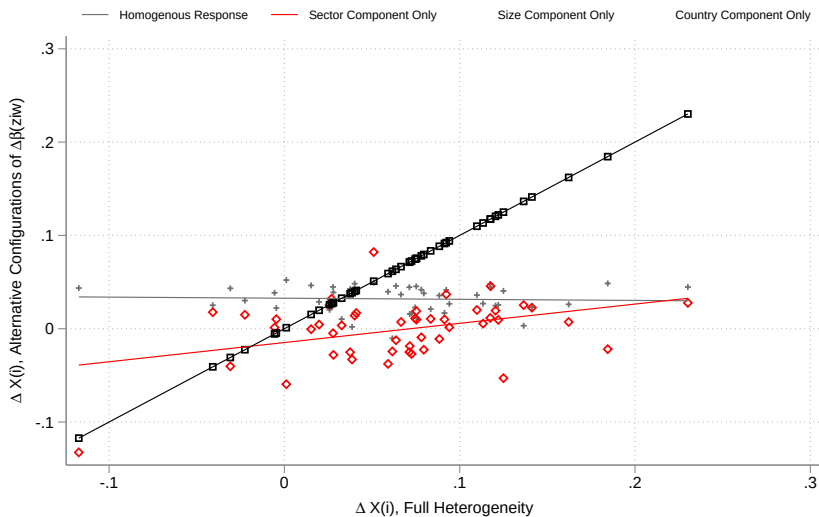
# Decomposing Relative Exports, $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{ji(\omega)}^n + \Gamma_z^n SIZE_{zi\omega}$

## Takeaway 3: Importance of Country Component



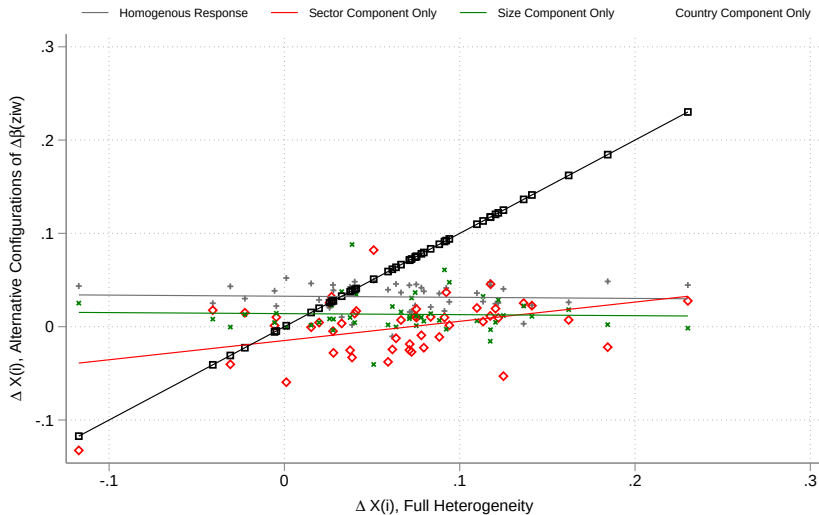
# Decomposing Relative Exports, $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{zj(\omega)}^n + \Gamma_z^n \text{SIZE}_{zi\omega}$

## Takeaway 3: Importance of Country Component



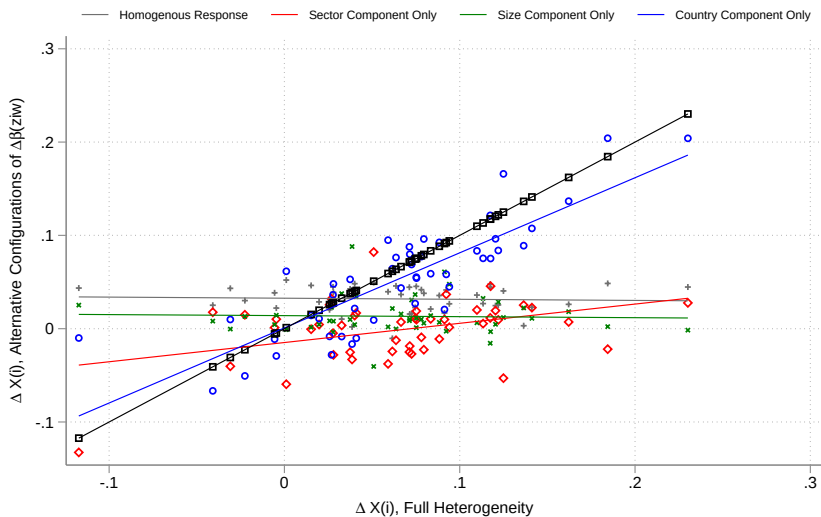
# Decomposing Relative Exports, $\beta_{ziw}^n = \beta_{zi}^n + \beta_{zj(w)}^n + \Gamma_z^n SIZE_{ziw}$

## Takeaway 3: Importance of Country Component



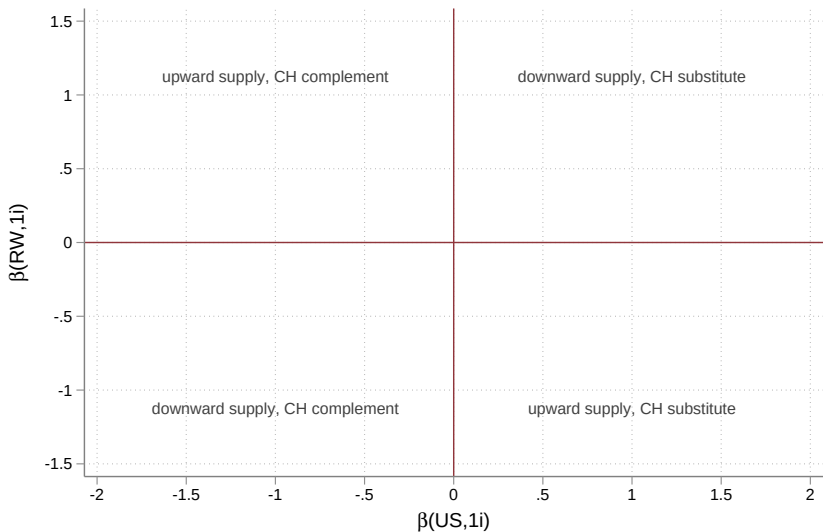
# Decomposing Relative Exports, $\beta_{zi\omega}^n = \beta_{zi}^n + \beta_{zj(\omega)}^n + \Gamma_z^n \text{SIZE}_{zi\omega}$

Takeaway 3: Importance of Country Component



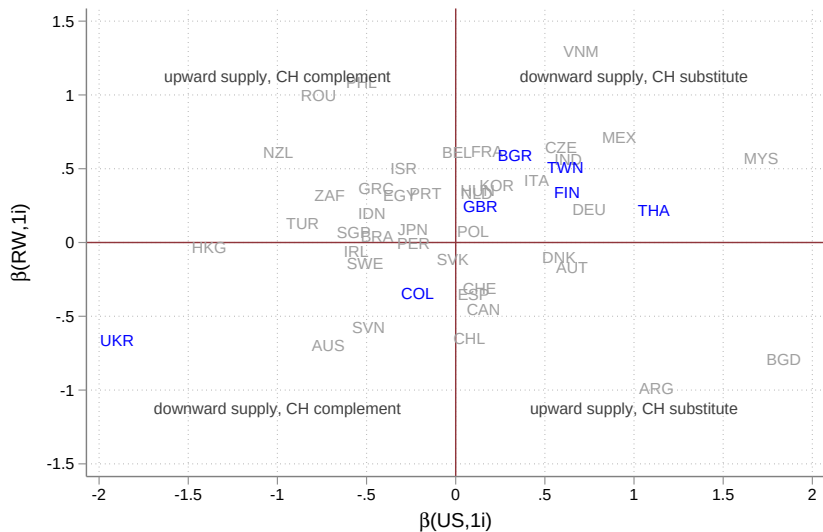
## Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response



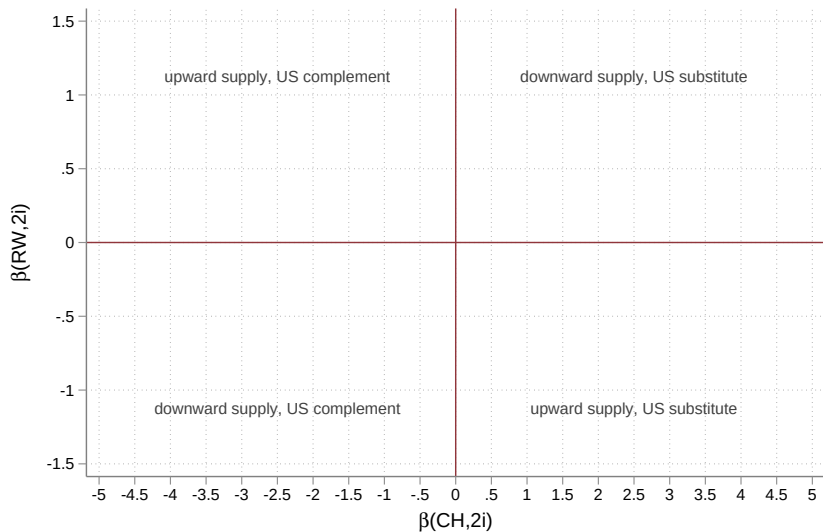
# Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response



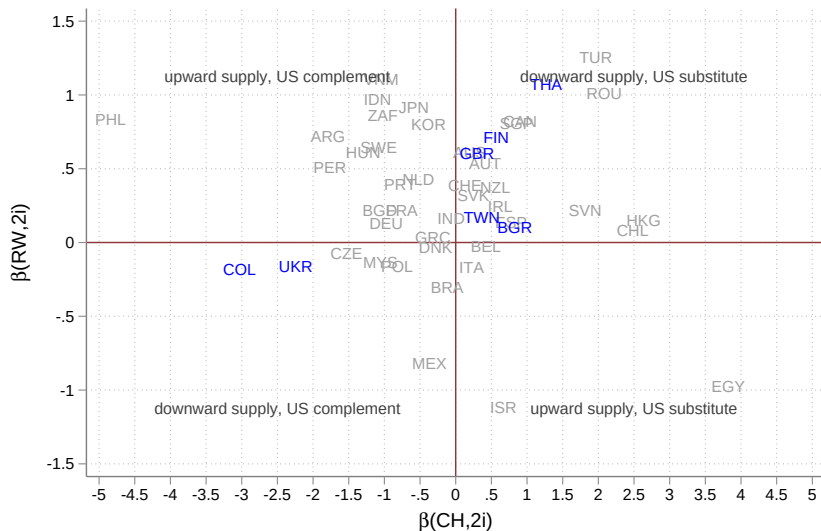
# Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response



# Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response



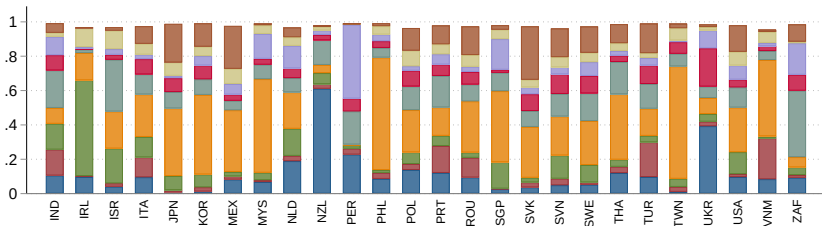
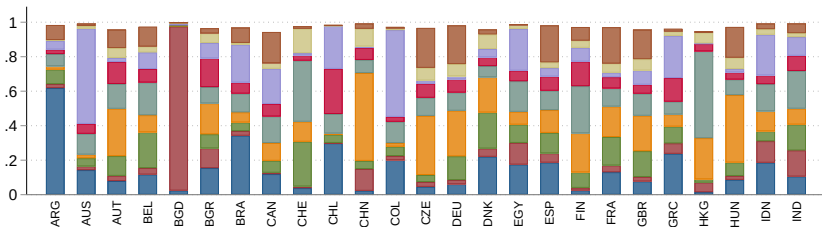


# Conclusion

- US-China trade war was seen as a major turning point in the globalization era
  - ▶ our results do not support this view, at least for the time horizon we analyze
  - ▶ several countries increased global exports in products with higher US-China tariffs, relative to non-taxed products
- Future work to uncover the factors driving the country-component of tariff elasticities

# Countries' Pre-War Export Baskets

■ Agriculture 
 ■ Apparel 
 ■ Chemicals 
 ■ Machinery 
 ■ Materials 
 ■ Metals 
 ■ Minerals 
 ■ Misc 
 ■ Transport



## Export Response to $US, CH, RW$ , All Coefficients

	(1) $\Delta \ln X_{i,\omega,t}^{US}$	(2) $\Delta \ln X_{i,\omega,t}^{CH}$	(3) $\Delta \ln X_{i,\omega,t}^{RW}$
$\Delta T_{CH,\omega}^{US} (\beta_1)$	0.21* (0.11)	-0.84*** (0.18)	0.12 (0.09)
$\Delta T_{US,\omega}^{CH} (\beta_2)$	-0.02 (0.11)	-0.06 (0.20)	0.35*** (0.08)
$\Delta T_{i,\omega}^{US} (\beta_3)$	-0.59** (0.29)	-0.12 (0.34)	0.09 (0.20)
$\Delta T_{i,\omega}^{CH} (\beta_4)$	-0.15 (0.21)	-1.46*** (0.40)	-0.19 (0.20)
Pre-trend control?	Yes	Yes	Yes
Country $\times$ Sector FE	Yes	Yes	Yes
R2	0.07	0.08	0.11
N	102,901	90,128	223,556

# Robustness: RW to RW

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta T_{CH,\omega}^{US} (\beta_1)$	0.12 (0.09)	0.12 (0.08)	0.10 (0.09)	0.29** (0.11)	0.11 (0.09)	0.08 (0.08)	0.07 (0.08)
$\Delta T_{US,\omega}^{CH} (\beta_2)$	0.35*** (0.08)	0.32*** (0.07)	0.29*** (0.08)	0.37*** (0.09)	0.34*** (0.08)	0.33*** (0.08)	0.34*** (0.08)
$\Delta T_{i,\omega}^{US} (\beta_3)$	0.09 (0.20)	0.09 (0.18)	0.26 (0.20)	-0.19 (0.26)	0.12 (0.20)	0.52*** (0.19)	0.54*** (0.19)
$\Delta T_{i,\omega}^{CH} (\beta_4)$	-0.19 (0.20)	-0.20 (0.19)	-0.01 (0.20)	0.73*** (0.27)	-0.21 (0.20)	0.30 (0.18)	0.26 (0.18)
Pre-trend control	Yes	Yes	No	Yes	Yes	Yes	Yes
Fixed Effects	cty-ind9	cty-ind9	cty-ind9	cty-hs2	ind9	cty	none
Winsorized	No	Yes	No	No	No	No	No
R2	.11	.097	.009	.14	.099	.1	.098
N	223,556	223,556	223,556	223,552	223,556	223,556	223,556
Exporters	48	48	48	48	48	48	48

Outcome is the log change in bystander countries' exports to countries other than the US and China. Column 1 is the baseline specification. Column 2 winsorizes the top and bottom 1% of the outcome. Column 3 excludes the pre-trend control. Columns 4-7 show robustness to alternative fixed effects: respectively, country-hs2, industry only, country only, and none.

[▶ return](#)

# Framework Details

- In country  $i$ , a bundle  $K_{ij}$  of inputs is used in tradeable sector  $j$
- Each unit  $k \in K_{ij}$  solves:

$$\max_{\omega} \max_x \left( p_{i\omega} z_{i\omega}^0 e_{\omega}^k \right)^{1-\alpha_j^l} x^{\alpha_j^l} - c_{ij}^l x,$$

- ▶  $z_{i\omega}^0 = Z_{i\omega} K_{i\omega}^{\gamma_i}$  captures scale effects
- ▶  $e_{\omega}^k$  is distributed Frechet with shape parameter  $\varepsilon_i$
- ▶  $c_{ij}^l$  is the cost of intermediates

- Yields  $X_{i\omega} \equiv A_{ij} p_{i\omega}^{\frac{1}{b_i}} Z_{i\omega}$  where

$$A_{ij} \equiv \left( \frac{c_{ij}^l}{\alpha_j^l} \right)^{\frac{\alpha_j^l}{\alpha_j^l - 1}} K_{ij}^{\frac{1}{b_i \varepsilon_i}} r_{ij}^{\frac{b_i - 1}{b_i}}$$

where

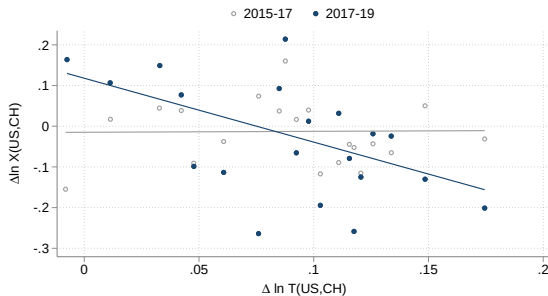
$$r_{ij}^{\varepsilon_i} = \sum_{\omega \in \Omega^j} \left( p_{i\omega} \left( c_{ij}^l / \alpha_j^l \right)^{\frac{\alpha_j^l}{\alpha_j^l - 1}} z_{i\omega}^0 \right)^{\varepsilon_i}$$

# China Exports to US on $\Delta T_{CH}^{US}$

China's exports to US fall with US tariff

$$\Delta X_{CH\omega}^{US} = \alpha_j + \beta \Delta T_{CH\omega}^{US} + \epsilon_{CH\omega}^{US}$$

**Panel A**  
China's Export Value to US



Pre-period:  $\beta=0.02$  (0.30). Post-period:  $\beta=-1.58$  (0.29).

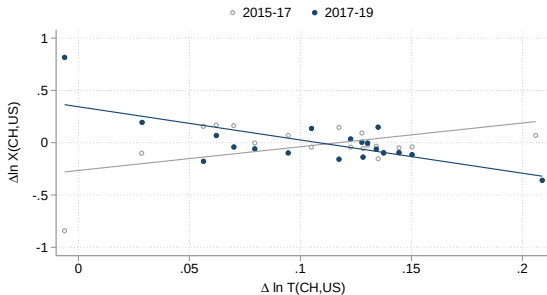
▶ back

# US Exports to China on $\Delta T_{US}^{CH}$

US exports to CH fall with CH tariff

$$\Delta X_{US\omega}^{CH} = \alpha_j + \beta \Delta T_{US\omega}^{CH} + \epsilon_{US\omega}^{CH}$$

**Panel B**  
US Export Value to China



Pre-period:  $\beta=2.26$  (0.48). Post-period:  $\beta=-3.18$  (0.44).

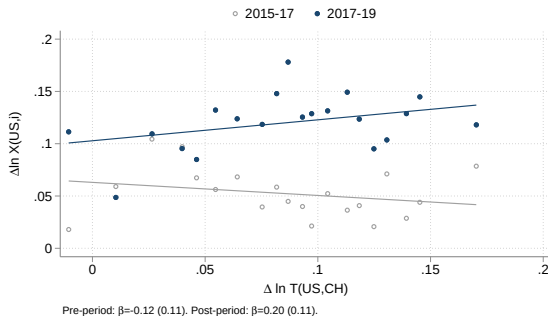
▶ back

# RW Exports to US on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to US increase with US tariff

$$\Delta X_{RW\omega}^{US} = \alpha_{ij} + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{US}$$

**Panel A**  
Bystanders' Export Value to US



▶ back

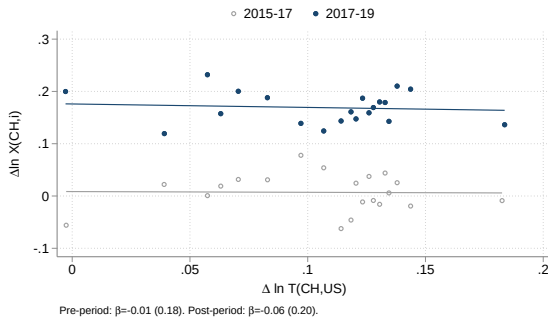


# RW Exports to CH on $\Delta T_{US}^{CH}$

Takeaway 1: RW exports to CH flat with CH tariff

$$\Delta X_{RW\omega}^{CH} = \alpha_{ij} + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{CH}$$

**Panel B**  
Bystanders' Export Value to China



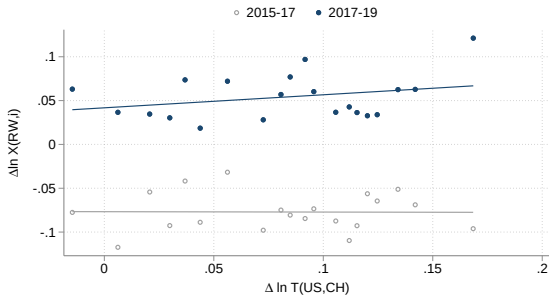
▶ back

# RW Exports to RW on $\Delta T_{CH}^{US}$

Takeaway 1: RW exports to RW increase with US tariff

$$\Delta X_{RW\omega}^{RW} = \alpha_{ij} + \beta \Delta T_{CH\omega}^{US} + \epsilon_{RW\omega}^{RW}$$

**Panel C**  
Bystanders' Export Value to RW



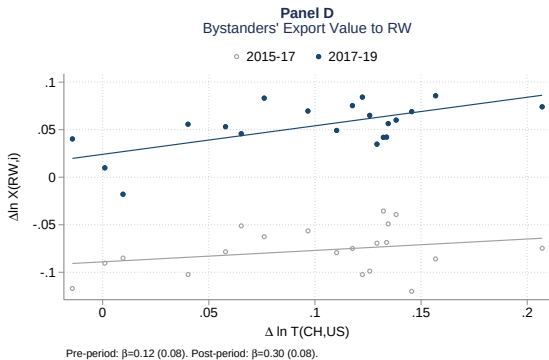
Pre-period:  $\beta = -0.00$  (0.09). Post-period:  $\beta = 0.15$  (0.09).

▶ back

# RW Exports to RW on $\Delta T_{US}^{CH}$

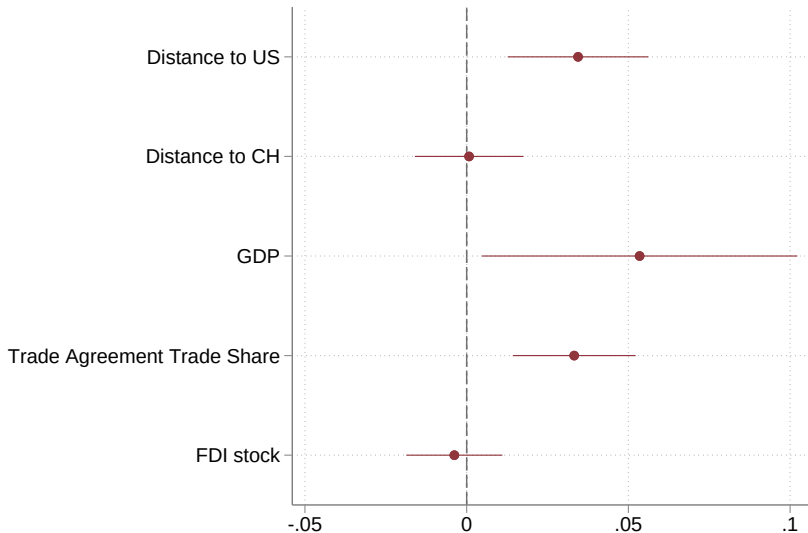
Takeaway 1: RW exports to RW increase with CH tariff

$$\Delta X_{RW\omega}^{RW} = \alpha_{ij} + \beta \Delta T_{US\omega}^{CH} + \epsilon_{RW\omega}^{RW}$$



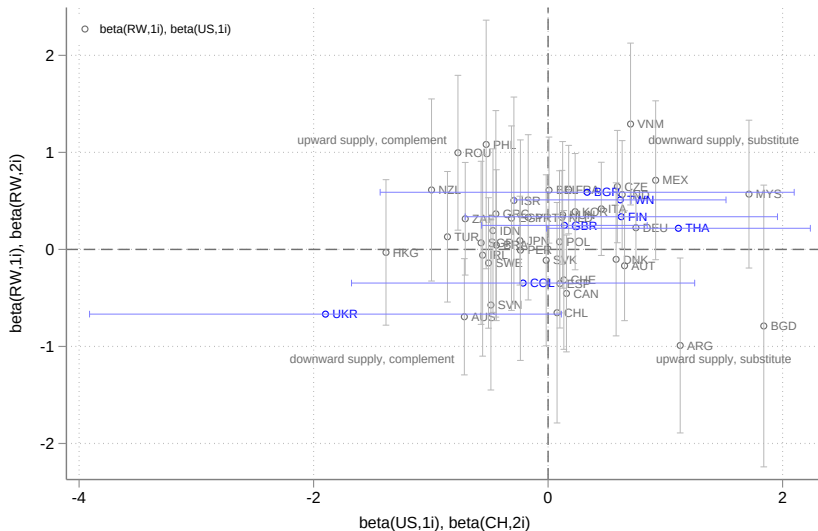
▶ back

# Export Growth Correlates



# Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response



# Supply and Demand Forces

## Takeaway 4: Supply and Demand Forces Driving Response

