Illuminating the Effects of the US-China Tariff War on China's Economy

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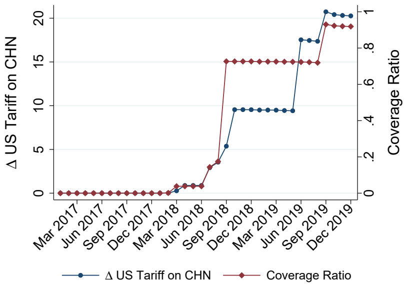
Introduction
The US-China Tariff War

Figure: Δ US Tariff on CHN relative to Jan 2017 (unweighted)

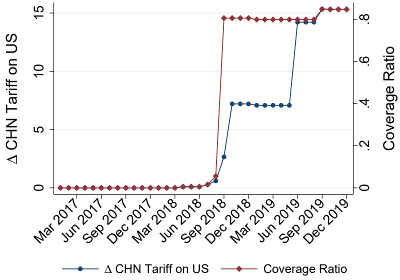


- By December 2019, US tariffs on China's exports
  - had surged by 20.7 percentage points on average,
  - covering 93% of HS 6-digit products, and 14.2% of the 2017 value of China's exports.
- What effects did this decline in external demand have on China's economy?

Introduction

The US-China Tariff War

Figure: Δ CHN Tariff on inputs from the US relative to Jan 2017 (unweighted)



- In December 2019, China's retaliatory tariffs on imports of inputs from the US
  - stood at an average of 16.6 percentage points,
  - covering 84.3% of HS 6-digit products, and 5.6% of the 2017 value of China's imports.
- Did rising costs for imported inputs further weigh down the Chinese economy?

Introduction
Literature

- Well-documented impact on bilateral trade flows: Amiti, Redding and Weinstein (2019), Fajgelbaum et al. (2020). ▸ Figure

- A body of evidence on the impact on the US economy. On:
  - Tariff pass-through, prices and consumption: Amiti, Redding and Weinstein (2019), Flaaen, Hortaçsu and Tintelnot (2020), Cavallo et al. (2021), Waugh (2019). Employment: Flaaen and Pierce (2019), Benguria and Saffie (2020), Fajgelbaum et al. (2020), Goswami (2020). Investment: Amiti, Kong and Weinstein (2020). Supply chains: Handley, Kamal and Monarch (2020), Charoenwong, Han and Wu (2020). Political economy: Fetzer and Schwarz (2019), Blanchard, Bown and Chor (2019), Kong (2020), Lake and Nie (2021), Li et al. (2022)

Introduction
Literature

- By comparison, less is known about the impact on China:
  - Abnormal stock returns of publicly-listed firms: Huang et al. (2020), Benguria et al. (2020). Business registrations: Cui and Li (2021). Online job postings: He et al. (2021). Trade flows and tariff pass-through: Jiao et al. (2020), Jiang et al. (2021), Tian et al. (2022). Model-based assessments: Ferraro and van Leemput (2019), Ju et al. (2020), Zhou (2020), Chen et al. (2022).
  - Due to data constraints and reporting lags on official Chinese data

    ... especially the high-frequency outcomes at the subnational level.

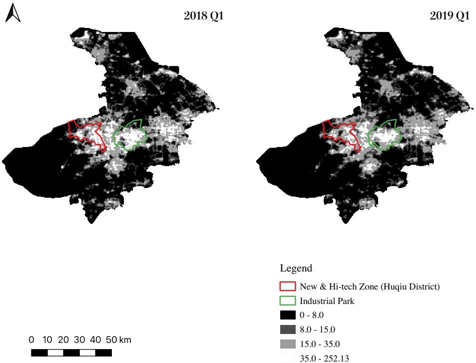
Introduction
Approach in this Project

- Exploit quasi-experimental variation in cross-location exposure to tariff shocks to identify their differential impacts on economic outcomes

- Use night lights to proxy for changes in economic activity
  - Higher spatial resolution and frequency
  - Sidesteps potential concerns with reporting in official economic data (Nakamura et al., 2016; Chen et al., 2019)
  - Chen and Nordhaus (2011), Henderson et al. (2012, 2017), Bleakley and Lin (2012), Michalopoulos and Papaioannou (2013), Pinkovskiy and Sala-i-Martin (2016), Storeygard (2016), Henderson et al. (2017), Chodorow-Reich et al. (2019), etc.

Empirical Strategy
An Illuminating Example

Figure: Night Light Intensity in Suzhou



Notes: From the VIIRS-DNB.

- 11km-by-11km grids (1/70 the size of Suzhou)
- $\sim$ 100,000 grid cells spanning mainland China
- Year-on-year change in mean log night lights was -0.105, -0.085, and -0.067, respectively, for the Huqiu New & Hi-tech Zone, the Suzhou Industrial Park, and the rest of Suzhou

Empirical Strategy

An Illuminating Example: What does this reflect?

- Night-shift activity in factories (affected by export demand)
- Occupancy in adjacent worker dormitories (i.e., labor demand)

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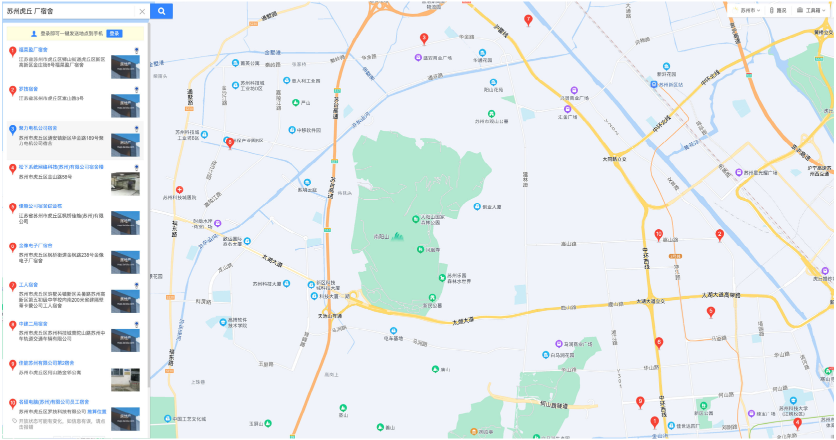


Introduction
Preview of Main Results

- Assemble a grid-level panel dataset at the quarterly frequency on: (i) exposure to tariff changes; and (ii) night lights
- Study the impacts of tariff hikes over the period Q1/2018-Q3/2019 on China's economy.
- Shift-share strategy $\implies$ A standard deviation higher grid-level exposure to US tariffs leads to slower growth in night lights by 1.63 log points (over 7 quarters)
- Mapping night lights to economic activity $\implies$ Inferred effect of one s.d. higher US tariff exposure: 0.77% lower GDP per capita, 0.49% lower manufacturing employment

Introduction
Preview of Main Results

- Skewed impact across grid locations:
  - Up to 70% of China's population with minimal US tariff exposure.
  - Tail 2.5% of China's population in most tariff-exposed grids: Inferred decrease in GDP per capita of 2.52%, in manufacturing employment of 1.62%.
- By contrast: Increase in input tariffs associated with China's retaliatory tariffs has statistically **in**significant effects.
  - Why? Will explore several hypotheses.
- The above are partial equilibrium effects. Controlling for spillover effects – a la Adão et al. (2020) – suggests that these reinforce the negative impact of the US tariffs. (Will also offer evidence that spillovers stem from labor reallocation.)

Data

Data

Tariffs (and other policy shocks)

- HS 6-digit product-level tariffs: From Bown (2019).
  - US: Section 201 (solar panels, washing machines), Section 232 (aluminium, steel products), Section 301 (Lists 1-4) ▸ US tariffs

    China: Retaliatory tariffs to each round ▸ CHN tariffs

    (Tariff exemptions coded in.)
  - Also: MFN tariffs from China's General Administration of Customs. ▸ CHN MFN tariffs
- Other data: Exchange rate movements, VAT changes, etc. ▸ Other Shocks

Data

Firm Geographic Coordinates and Grid-level Export (Import) Structure

- 2016 China Customs data: $\approx$ 280,000 non-intermediary firms
- Locate each firm's geographic coordinates (i.e., longitude and latitude) based on search results from:
  (1) Google Maps API
  (2) Amap API (maintained by the Alibaba Group)
- Map firms and associated transactions to grids
  $\Longrightarrow$ export and import activities at the grid$\times$HS6 level.
- However: Geo-coordinates from a single web mapping service could be subject to inaccuracy (attenuation bias) Comparison
  - Hence: Use measures constructed with the geodata from Amap as IVs for the measures constructed based on Google Maps (or vice versa).

Data
Night Lights

- Night-time luminosity: the VIIRS-DNB dataset
  - Monthly averages of night lights intensity in 15 arc-second geographic grids, from April 2012.
  - Filtered to exclude observations impacted by lightning, lunar illumination, cloud-cover, and stray light during the summer.
  - Relative to its predecessor DMSP-OLS: Overpass is at 1.30am, but readings are not top-coded.

Empirical Strategy

Empirical Strategy
Specification

$$\Delta \ln(Light_{it}) = \pi_1 \Delta USTariff_{it-1} + \pi_2 \Delta CHNInputTariff_{it-1} + W_{i0} \times D_t + D_{pt} + D_i + u_{it}.$$

- Run on a grid-level panel at the quarterly frequency
- Sample period: Q2/2018 to Q4/2019
- D_{pt} and D_i: prefecture×year-quarter and grid FEs, respectively
- W_{i0}: initial characteristics at the grid level, interacted with year-quarter FEs, D_t, to control for associated trends
- Weighted by grid population; standard errors clustered at the province level.

Empirical Strategy

Tariff Shock Measures

- Year-on-year change in US tariffs faced by Chinese exporters in grid i:

$$\Delta USTariff_{it} = \sum_k \frac{X_{ik0}^{US}}{X_{i0}} \Delta USTariff_{kt}$$

  - $\Delta USTariff_{kt}$: year-on-year change in US tariff for HS 6-digit product k from China
  - X_{ik0}^{US}/X_{i0}: exports of product k to the US as a share of total exports from grid i in the base year.

- Cumulative change in $USTariff_{it}$ up to Q3/2019:
  Pop-wtd average of 1.15pp, with s.d. of 2.76pp.
  (95th percentile: 5.59pp.)

Empirical Strategy
Tariff Shock Measures

- Year-on-year change in Chinese retaliatory tariffs:

$$\Delta CHNInputTariff_{it} = \sum_{k \in \mathcal{K}} \frac{M^{US}_{ik0}}{M_{i\mathcal{K}0}} \Delta ImportTariff_{kt}$$

  - $\Delta ImportTariff_{kt}$: year-on-year change in China's tariffs on HS 6-digit product k from the US
  - $M^{US}_{ik0}/M_{i\mathcal{K}0}$: imports of k sourced from the US as a share of total imports of intermediate and capital goods ($k \in \mathcal{K}$, UN BEC) in grid i in the base year.

- Cumulative change in $CHNInputTariff_{it}$ up to Q3/2019:
  Pop-wtd average of 0.55pp, with s.d. of 2.23pp.
  (95th percentile: 2.31pp.)

Import comp.

Empirical Strategy
Discussion of Identification

- Require that, conditional on included controls, u_{it}'s are uncorrelated with either: (i) the initial grid-level export/import shares (Goldsmith-Pinkham et al. 2020); or: (ii) the product-specific tariff shocks (Borusyak et al. 2020).

- On (ii):

  - Initial Section 301 lists targeted intermediates rather than final goods (Bown and Kolb 2021)
  - Also: Directed at products linked with the "Made in China 2025" industry policy plan (Ju et al. 2020)

Empirical Strategy
Discussion of Identification (cont.)

- View identification as stemming from the plausible exogeneity of the grid-level trade shares:

  $E[(X^{US}_{ik0}/X_{i0})u_{it} \mid \mathcal{W}] = 0$ and $E[(M^{US}_{ik0}/M_{i\mathcal{K}0})u_{it} \mid \mathcal{W}] = 0$

  - Granular grid cells: Boundaries do not systematically coincide with those of administrative or economic zones.

Empirical Strategy
Discussion of Identification (cont.)

- View identification as stemming from the plausible exogeneity of the grid-level trade shares:

  $E[(X^{US}_{ik0}/X_{i0})u_{it} \mid \mathcal{W}] = 0$ and $E[(M^{US}_{ik0}/M_{i\mathcal{K}0})u_{it} \mid \mathcal{W}] = 0$

  – Control for $W_{i0} \times D_t$: Trends in night lights that might be driven by grid-level characteristics correlated with trade shares.

  W_{i0} includes: US share in exports, US share in imports of intermediates, log exports per capita, log intermediate imports per capita, log mean night lights intensity. Also: log population, trade shares by 15 HS segments, US trade shares by 15 HS segments, SOE export share.

  – Control for other contemporaneous shocks – exchange rates, MFN rates, value added taxes – that might affect grid-level night lights through the same trade shares.

Empirical Results

Empirical Results

Tariff Shocks and Night Light Intensity, 2SLS

Table: Tariff Shocks and Night Lights Intensity

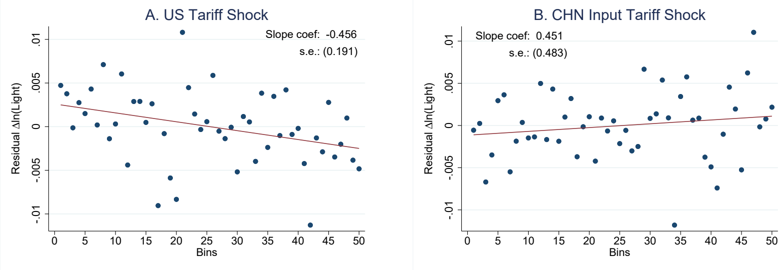
Dep. Var.: $\Delta \ln(Light_{it})$	(1) **2SLS**	(2) **2SLS**	(3) **2SLS**	(4) **2SLS**	(5) OLS-RF	(6) **2SLS**
$\Delta USTariff_{i,t-1}$	-0.7702***		-0.7851***	**-0.5903****	-0.2523**	-1.1555**
	(0.2166)		(0.2099)	(0.2673)	(0.1115)	(0.4839)
$\Delta CHNInputTariff_{i,t-1}$		-0.0619	0.1051	**0.5509**	0.1631	0.3897
		(0.3202)	(0.3299)	(0.5555)	(0.1766)	(0.9943)
Grid FE	Y	Y	Y	Y	Y	Y
Prefecture×Year×Quarter FE	Y	Y	Y	Y	Y	Y
Grid W_{i0}×Year×Quarter FE	N	N	N	Y	Y	Y
Grid FE×Linear Time Trend	N	N	N	N	N	Y
Observations	669,845	669,845	669,845	669,845	669,845	669,845
F-stat	183.8	72.31	37.33	21.22	–	10.92

More $W_{i0} \times D_t$ controls

Empirical Results

Tariff Shocks and Night Light Intensity, 2SLS

Figure: Growth in Night Lights across Tariff Bins



Notes: Based on Column 4. A simple linear regression line across the 50 bins is reported for each binned scatterplot.

Robustness and Additional Results

- Extension to 2020: time-varying effects ▸ Extension 2020
- No grid-specific pretrends ▸ Pre-trends
- Placebo, import comp., and other tariff shocks ▸ Alt. Tariff Shocks
- Other contemporaneous policy shocks ▸ Other Shocks
- Alternative specifications ▸ Alt. Specifications
- Alternative two-way fixed effects estimator (de Chaisemartin and D'Haultfoeuille, 2020) ▸ Alt. Estimator
- Random permutation tests (Adão et al. 2019) ▸ Permutations
- Product-level analysis ▸ Product Level

Robustness and Additional Results (cont.)

- Why no impact of China's retaliatory tariffs?
  - Imports from the US subject to retaliatory tariffs constituted (only?) 5.6% of China's imports before the trade war.
  - Imports under the processing trade regime already tariff-exempt.
  - Some stockpiling in anticipation of tariff hikes.
  - Some offsetting effect from decreases in MFN tariffs.
  - Some evidence of increased imports from ROW. Product Level
  - Substitution from domestic sources also possible, though lack direct data on this.

Robustness and Additional Results (cont.)

- Why no impact of China's retaliatory tariffs?
  - Imports from the US subject to retaliatory tariffs constituted (only?) 5.6% of China's imports before the trade war.
  - Imports under the processing trade regime already tariff-exempt. Input tariff $\uparrow \implies$ switch to processing trade
  - Some stockpiling in anticipation of tariff hikes.
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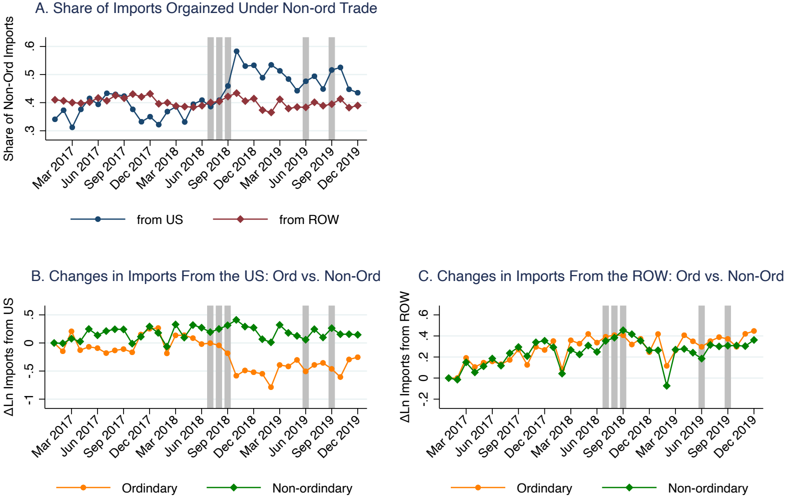
  - Some evidence of increased imports from ROW. Product Level
  - Substitution from domestic sources also possible, though lack direct data on this.

The Roles of Ordinary and Processing Imports



Notes: Panel A plots the shares of imports organized through non-ordinary trade from different origins (the US and the ROW) over time. Panel B presents the change in log imports from the US that is organized through different trade modes (ordinary v.s. non-ordinary), relative to the initial value in January 2017. Panel C is analogous to Panel B, but focuses on the change in log imports from the ROW.

The Roles of Ordinary and Processing Imports (cont.)

- Split the China input tariff shocks into two components, based on ordinary trade intensity in pre-period non-US imports.
- A negative (resp. positive) effect of input shock where processing imports are less (resp. more) prominent. Consistent with a reallocation across import regime/mode.

Product-Level Evidence

Dep. Var.: $\Delta \ln(Light_{it})$	(1)	(2)	(3)	(4)
$\Delta USTariff_{i,t-1}$	-0.9940***	-0.7839**	-0.8533***	-0.6522**
	(0.3081)	(0.3634)	(0.2079)	(0.2556)
$\Delta CHNInputTariff_{i,t-1}^{Low\ Ord}$	**1.2065***	1.8963**	1.1072*	1.9277**
	(0.6499)	(0.8190)	(0.6396)	(0.9435)
$\Delta CHNInputTariff_{i,t-1}^{High\ Ord}$	**-1.2835****	-1.0465*	-1.0111**	-0.8043†
	(0.5249)	(0.5628)	(0.4877)	(0.5277)
Grid FE	Y	Y	Y	Y
Province×Year-Quarter FE	Y	Y	N	N
Prefecture×Year-Quarter FE	N	N	Y	Y
Grid W_{i0}×Year-Quarter FE	N	Y	N	Y
Observations	669,845	669,845	669,845	669,845
F-stat	10.64	7.263	9.980	5.975

Mapping Night Lights to Economic Activity

Mapping Night Lights to Economic Activity

- Estimate inverse elasticity of night lights to per capita GDP based on the statistical framework of Henderson et al. (2012)

- Posit that *measured* per capita GDP (z_{it}) and night lights (x_{it}) are related to *actual* per capita GDP (y_{it}) in the following way:

$$z_{it} = y_{it} + \varepsilon_{z,it}$$

$$x_{it} = \beta y_{it} + \varepsilon_{x,it}$$

  Common assumptions in the literature: $cov(\varepsilon_{z,it}, \varepsilon_{x,it}) = 0$.

- β: elasticity of luminosity to income

$$\implies \quad z_{it} = \frac{1}{\beta} x_{it} \underbrace{- \frac{1}{\beta} \varepsilon_{x,it} + \varepsilon_{z,it}}_{\nu_{it}} .$$

Mapping Night Lights to Economic Activity

- Cross-sectional OLS delivers estimate of $\frac{1}{\beta}$ that is downward biased, since $cov(x_{it}, \nu_{it}) \neq 0$.
- Instead: We leverage the panel dimension of the data. Under the additional assumption that $cov(\varepsilon_{x,it}, \varepsilon_{x,it-1}) = 0$:

  (i.e., night lights measurement error is serially independent.)

$$\left(\frac{1}{\beta}\right)^{IV} = \frac{cov(z_{it}, x_{it-1})}{cov(x_{it}, x_{it-1})} = \frac{1}{\beta}$$

$\implies x_{it-1}$ as an instrument for x_{it}.

- In practice: Use prefecture-level data over 2012-2016 at the annual frequency (from the China City Statistical Yearbooks).

$$\ln(Y_{js}) = (1/\beta)\ln(Light_{js}) + D_j + D_{vs} + \nu_{js}$$

Mapping Night Lights to Economic Activity

Table: GDP, Employment and Night Lights Intensity
Cross-Prefecture Panel Data (2012-2016)

Panel A.	Dep. Var.: $\ln(GDPpc_{jt})$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
$\ln(Light_{jt})$	0.2238***	0.1955***	0.1563***	0.4104*	0.4667**	**0.4698*** **	0.5534***
	(0.0601)	(0.0518)	(0.0343)	(0.2273)	(0.1821)	(0.1536)	(0.1935)
Observations	1,133	1,115	1,018	1,133	1,115	1,018	1,018
R-squared	0.9772	0.9839	0.9909	—	—	—	—
F-stat	—	—	—	54.43	41.18	29.80	28.48
Panel B.	Dep. Var.: $\ln(Emp_{jt})$						
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
$\ln(Light_{jt})$	0.0895*	0.0748**	0.0820**	0.4704**	0.2708***	**0.3021** **	0.3014**
	(0.0523)	(0.0281)	(0.0355)	(0.1922)	(0.0918)	(0.1242)	(0.1182)
Observations	1,133	1,116	1,013	1,133	1,116	1,013	1,013
R-squared	0.9853	0.9926	0.9949	—	—	—	—
F-stat	—	—	—	54.43	48.44	47.58	67.37
Province×Year FE	Y	Y	Y	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y	Y	Y	Y
Trimmed	N	Tail 1%	Tail 5%	N	Tail 1%	Tail 5%	Tail 5%
Weighted by population	N	N	N	N	N	N	Y

▸ Alt. Aggregation Level ▸ Scatter Plot ▸ Other Benchmarks

Mapping Night Lights to Economic Activity

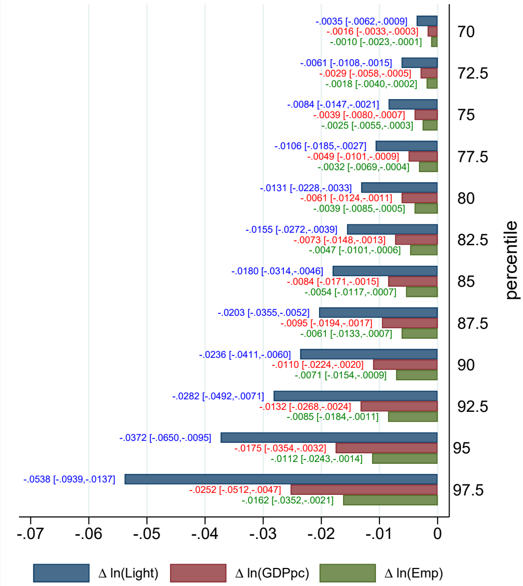
- The pop-wtd s.d. of grid-level exposure to the US tariff hikes up to Q3/2019 was 2.76pp

  $\Longrightarrow$ $1.63(=0.59\times2.76)$ log points slower growth in night lights intensity

  $\Longrightarrow$ $0.77\text{pp}(=0.47\times1.63)$ slower GDP per capita growth

  Analogously: 0.49pp slower manufacturing employment growth

Mapping Night Lights to Economic Activity



- Minimal impact for up to 70% of China's population.
- Tail 2.5% of China's population in most tariff-exposed grids:

  GDPpc ↓2.52%

  Mfg. emp. ↓1.62%

  (Located in ≈ 2/3 of China's prefectures)

Local and Neighboring Tariff Shocks

- What about the full effect (i.e., with general equilibrium forces)?
- Following Adão, Arkolakis and Esposito (2020): Capture through a specification that includes both local and nonlocal tariff exposure terms, the latter as a weighted-average of shift-share variables across all other locations.
- Several approaches to construct nonlocal tariff exposure:
  - Market-potential-wtd avg across grids in neighboring rings Go
  - Market-potential-wtd avg across prefecture-level tariff shocks Go
- Own-exposure to the US tariffs remains stable and significant.

  When statistically significant, nonlocal tariff exposure terms have a negative sign, i.e., reinforcing the dimming of night lights.

Spillovers across Grid Cells: Commuting Flows

- Consistent with Monte, Redding and Rossi-Hansberg (2018), responses larger in grids with higher commuting openness.

  (County-level commuting intensities: From the 2015 China mini-census)

Dep. Var.: $\Delta \ln(Light_{it})$ Measure of Commuting Openness:	(1)	(2) $1-\lambda^{R}_{cc\|c}$	(3) $1-\lambda^{L}_{cc\|c}$
$\Delta USTariff_{i,t-1}$	-0.6320**		
	(0.2709)		
Commuting Openness$_c$: above medium $\times$ $\Delta USTariff_{i,t-1}$		**-0.7504*** **	-0.7414**
		(0.2685)	(0.2806)
Commuting Openness$_c$: below medium $\times$ $\Delta USTariff_{i,t-1}$		**-0.1337**	-0.2590
		(0.3874)	(0.3340)
$\Delta CHNInputTariff_{i,t-1}$	0.4071		
	(0.5401)		
Commuting Openness$_c$: above medium $\times$ $\Delta CHNInputTariff_{i,t-1}$		0.5191	0.8053
		(0.4863)	(0.4924)
Commuting Openness$_c$: below medium $\times$ $\Delta CHNInputTariff_{i,t-1}$		-0.1991	-1.0698
		(1.6131)	(1.0782)
Grid FE	Y	Y	Y
Prefecture$\times$Year-Quarter FE	Y	Y	Y
Grid $W_{i0}$$\times$Year-Quarter FE	Y	Y	Y
Observations	343,222	343,222	343,222
F-stat	27.18	16.19	13.66

More

Prefecture Level Analysis

- Relates more directly to "local labor market approach" (though the identification maybe cleaner with grid-level analysis)

Dep. Var.: $\Delta \ln(Light_{jt})$	(1)	(2)	(3)	(4)
$\Delta USTariff_{j,t-1}$	-0.6443**	-0.6325**	-0.7578*	-0.6858**
	(0.2903)	(0.2938)	(0.3647)	(0.3125)
$\Delta CHNInputTariff_{j,t-1}$	-0.3694	-0.3697	-0.2459	-0.2913
	(0.3007)	(0.3112)	(0.3483)	(0.3461)
$\Delta CHNExpWtdTariff_{j,t-1}$		-0.0069		
		(0.4955)		
Non-local $\Delta USTariff_{j,t-1}$:			-1.8933*	
neighboring prefecture			(1.1062)	
Non-local $\Delta CHNInputTariff_{j,t-1}$:			1.0352	
neighboring prefecture			(0.7526)	
Non-local $\Delta USTariff_{j,t-1}$:				0.3102
all prefectures				(0.6741)
Non-local $\Delta CHNInputTariff_{j,t-1}$:				0.9118
all prefectures				(0.8306)
Prefecture FE	Y	Y	Y	Y
Province×Year-Quarter FE	Y	Y	Y	Y
Prefecture W_{j0}×Year-Quarter FE	Y	Y	Y	Y
Observations	2,247	2,247	2,247	2,247
R^2	0.7214	0.7215	0.7233	0.7222

County Level Analysis

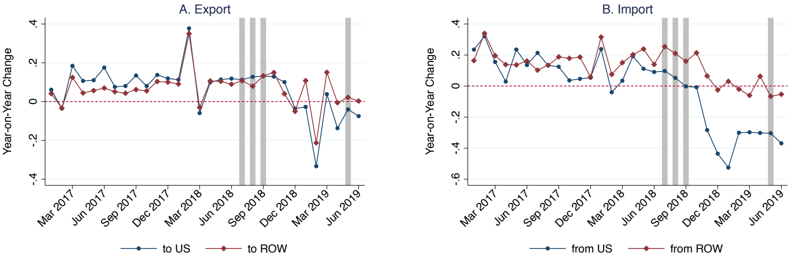
Dep. Var.: $\Delta\ln(Light_{ct})$	(1)	(2)	(3)	(4)
Sample:	All	Counties with data on commuting flows		
Measure of Commuting Openness:			$1-\lambda^{R}_{cc\|c}$	$1-\lambda^{L}_{cc\|c}$
$\Delta USTariff_{c,t-1}$	-0.5683*	-0.6130*		
	(0.3338)	(0.3421)		
$\Delta CHNInputTariff_{c,t-1}$	-0.1405	-0.0565		
	(0.5559)	(0.5680)		
Commuting Openness$_c$: above medium $\times$ $\Delta USTariff_{c,t-1}$			-0.7406*	-0.7734*
			(0.4278)	(0.4482)
Commuting Openness$_c$: below medium $\times$ $\Delta USTariff_{c,t-1}$			-0.4947	-0.5156
			(0.3392)	(0.3915)
Commuting Openness$_c$: above medium $\times$ $\Delta CHNInputTariff_{c,t-1}$			-0.0641	0.6852
			(0.5251)	(0.5396)
Commuting Openness$_c$: below medium $\times$ $\Delta CHNInputTariff_{c,t-1}$			-0.0575	-0.5217
			(0.7739)	(0.6047)
County FE	Y	Y	Y	Y
Prefecture$\times$Year-Quarter FE	Y	Y	Y	Y
County $W_{c0}\times$Year-Quarter FE	Y	Y	Y	Y
Observations	12,341	11,249	11,249	11,249
F-stat	12.20	12	6.280	5.821

Conclusion

- Locations that were initially more specialized in selling products to the US and that were subject to rising US tariffs experienced slower economic growth.
- Impact is very skewed across grids, and consequential for the most tariff-exposed locations.
- China's retaliatory tariffs appear to have had an insignificant effect on local economic growth (likely due to switching to bring in inputs under the processing trade regime)
- Would argue that estimates presented are arguably lower bounds for the full effect.
- Use of night lights circumvents data constraints. But much scope for work to corroborate these estimates, or to perform assessments of the longer term impact (e.g., on investment).

Appendix

Figure: Year-on-Year Changes in Trade Flows

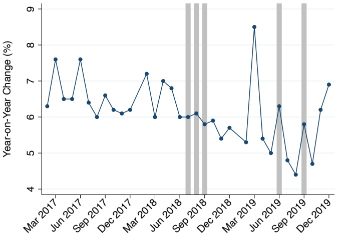


Notes: The shaded areas in panel A indicate the onsets of different phases of the US 301 section tariff actions. The shaded areas in panel B indicate different phases of China's retaliatory tariff actions.

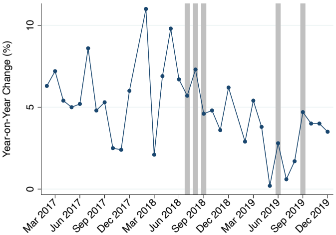
Introduction
The US-China Tariff War

Figure: Macro Economic Indicators

A: Value Added of Industry



B: Production of Electricity



Sources: National Bureau of Statistics.
Notes: The shaded areas indicate the onsets of different phases of the US 301 section tariff actions.

US-China Tariff War: Timeline

Table: US Tariff Actions

Effective Dates	Description of US Tariff Increase	Cumulative Share of HS 6-digit Products	Cumulative 2017 Export Share: All Products	Cumulative 2017 Export Share: Intermediate and Capital goods
February 7, 2018	Section 201 tariffs on solar panels Section 201 tariffs on washing machines	0.14%	0.09%	0.08%
March 23, 2018	Section 232 tariffs on steel Section 232 tariffs on aluminum	3.80%	0.25%	0.24%
July 6, 2018	Section 301 List 1	14.38%	2.92%	2.80%
August 23, 2018	Section 301 List 2	17.48%	3.25%	3.13%
September 24, 2018	Section 301 List 3	72.63%	10.02%	8.79%
June 1, 2019	Additional 15% tariff on Section 301 List 3	72.30%	9.97%	8.74%
September 1, 2019	Section 301 List 4A	93.02%	14.20%	9.99%

Back

US-China Tariff War: Timeline

Table: China's Retaliatory Tariff Actions

Effective Dates	Description of China's Tariff Increase	Cumulative Share of HS 6-digit Products	Cumulative 2017 Import Share	
			All Products	Intermediate and Capital goods
April 2, 2018	Retaliation to US Section 232 tariffs	1.71%	0.16%	0.05%
July 6, 2018	Retaliation to US Section 301 List 1	7.20%	1.96%	1.77%
August 23, 2018	Retaliation to US Section 301 List 2	10.38%	2.75%	2.54%
September 24, 2018	Retaliation to US Section 301 List 3	80.38%	6.10%	5.70%
January 1, 2019	Suspension of retaliatory tariffs on auto and parts	79.86%	5.31%	4.91%
June 1, 2019	Increase in retaliatory tariffs on some products	79.86%	5.31%	4.91%
September 1, 2019	Retaliation to US Section 301 List 4	84.33%	5.55%	5.15%

Back

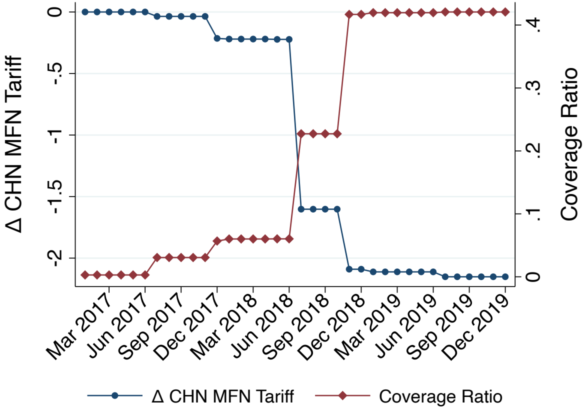
US-China Tariff War: Timeline

Table: Changes to China's MFN tariffs

Effective Dates	Description of MFN Tariff Reduction	Cumulative Share of HS 6-digit Products	Cumulative 2017 Import Share: All Products	Cumulative 2017 Import Share: Intermediate and Capital goods
July 1, 2017	Information Technology Agreement tariff cut	3.06%	20.92%	20.38%
December 1, 2017	Tariff cut on consumer goods	5.68%	23.01%	21.41%
January 1, 2018	Interim MFN rates for 2018	6.01%	23.89%	22.29%
May 1, 2018	Tariff cut on pharmaceuticals	6.03%	23.91%	22.31%
July 1, 2018	Tariff cut on broken rice Information Technology Agreement tariff cut Tariff cut on consumer goods Tariff cut on autos and auto parts	22.72%	29.84%	26.93%
November 1, 2018	Tariff cut on industrial goods	41.69%	34.62%	31.70%
January 1, 2019	Interim MFN rates for 2019	41.96%	34.70%	31.76%
July 1, 2019	Information Technology Agreement tariff cut	42.08%	35.58%	32.64%

Back

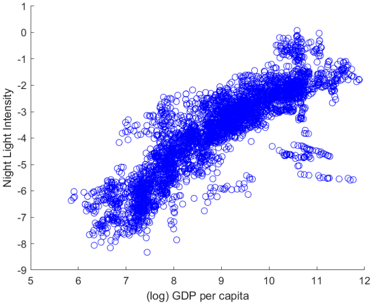
Changes in MFN Tariffs



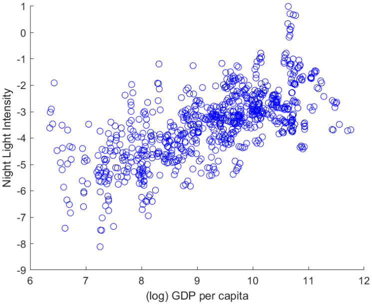
- The simple average of China's MFN tariffs declined by 2.2pp by September 2019.

Back

Comparison of the VIIRS-DNB and the DMSP-OLS



(a) DMSP/OLS 1992-2013

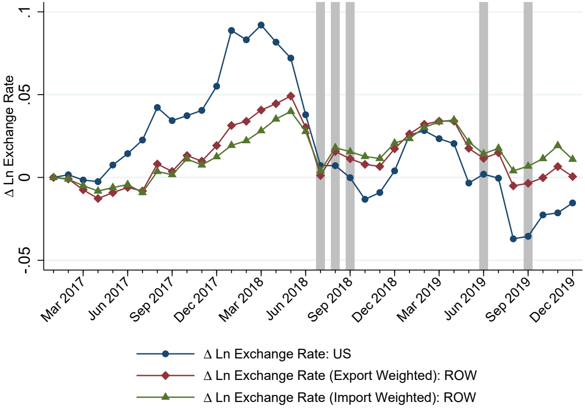


(b) Suomi-NPP/VIIRS 2013-2017

Source: Hu and Yao (2019)

▸ Back

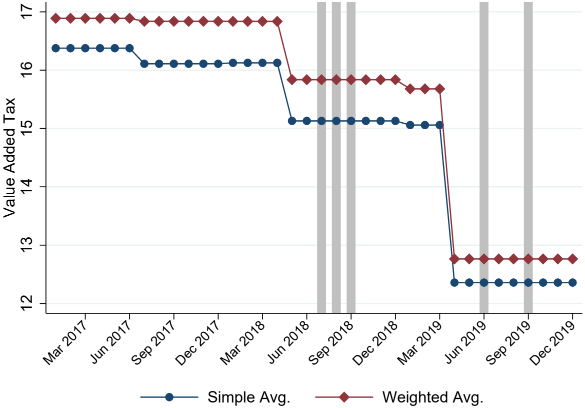
Changes in Exchange Rate During the US-China Trade War



- Against the USD, by September 2019, RMB depreciated by 12.9 log points from its peak in March 2018

Back

Changes in VAT During the US-China Trade War



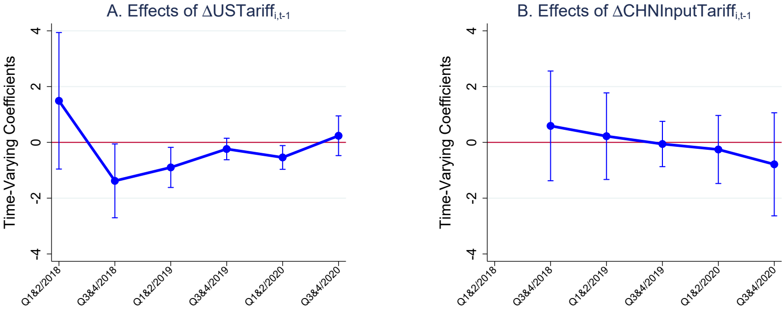
- The simple average of value added tax rates declined from 16.9 percent in early 2017 to 12.8 percent by June 2019.

Back

Empirical Results

Extended Sample Period through End-2020

Figure: Effects of Tariffs on Night Lights Intensity in Different Periods



Notes: The figure plots the coefficients of the US tariff and CHN input tariff shock variables respectively, from an extended version of the baseline specification that extends the sample period to cover Q1/2018 through Q4/2020, and incorporates time-varying coefficients for each half-year. The effect of China input tariff exposure for Q1&Q2/2018 is not estimated, as $\Delta CHNInputTariff_{i,t-1}$ is uniformly equal to zero for $t = Q1/2018$ and $t = Q2/2018$. Standard errors are clustered at the province level; error bands show the 90% confidence intervals.

▸ Back

Geodata from Google Maps and the Amap

	Google Maps	Amap	Overlap/Correlation		
Number of firms that can be located	271,565	226,039	220,919		
Latitude	30.619	30.334	0.986		
Longitude	117.680	117.489	0.956		
	mean	std	p25	p50	p75
Distance of Google Maps and Amap locations (km)	31.901	156.704	0.032	5.243	20.945

Back

Additional Tariff Shock Measure:
Protection Motive against Import Competition

- Year-on-year change in US tariffs faced by Chinese exporters in grid i:

$$\Delta USTariff_{it} = \sum_{k \in \mathcal{K}} \frac{X_{ik0}}{X_{i0}} \Delta ImportTariff_{kt}$$

  - $\Delta ImportTariff_{kt}$: year-on-year change in China's tariffs on product k from the US
  - X_{ik0}/X_{i0}: exports of product k as a share of total exports from grid i in the base year.
  - Use grid-level export shares as a proxy for local share of production activity for said product

Back

Dep. Var.: $\Delta \ln(Light_{it})$	(1)	(2)	(3)	(4)	(5)
$\Delta USTariff_{i,t-1}$	-0.5803**	-0.5407**	-0.6587**	-0.5768**	-0.6398***
	(0.2626)	(0.2471)	(0.2494)	(0.2629)	(0.2237)
$\Delta CHNInputTariff_{i,t-1}$	0.5219	0.2120	0.2969	0.5374	0.1754
	(0.5636)	(0.6546)	(0.8646)	(0.5565)	(0.8640)
Grid FE	Y	Y	Y	Y	Y
Prefecture×Year-Quarter FE	Y	Y	Y	Y	Y
Grid W_{i0}×Year-Quarter FE	Y	Y	Y	Y	Y
Additional Grid W_{i0}×Year-Quarter FE	Log Population	Trade shares by HS Segment	Trade Shares, US by HS Segment	State-Owned Export Share	All together
Observations	669,845	669,845	669,845	669,845	669,845
F-stat	21.36	21.92	25.01	21.10	25.09

Back

Dep. Var.:	(1) $\Delta \ln(Light_{it})$	(2) $\Delta \ln(Light_{i,t-1})$	(3) $\Delta \ln(Light_{i,t-2})$	(4) $\Delta \ln(Light_{i,t-3})$
$\Delta USTariff_{i,t-1}$	-0.5903**	-0.2631	0.1072	0.0808
	(0.2673)	(0.2699)	(0.2584)	(0.3750)
$\Delta CHNInputTariff_{i,t-1}$	0.5509	0.3239	-0.0516	0.1986
	(0.5555)	(0.4651)	(0.3561)	(0.5362)
Grid FE	Y	Y	Y	Y
Prefecture×Year×Quarter FE	Y	Y	Y	Y
Grid W_{i0}×Year×Quarter FE	Y	Y	Y	Y
Observations	669,845	669,845	669,846	673,052
F-stat	21.22	21.22	21.22	21.22

Back

Dep. Var.: $\Delta\ln(Light_{it})$	Placebo ADH8 Weights for Tariff Shocks (1)	Controlling for Consumption Tariff Shocks (2)	Controlling for Exp.-Weighted Input Tariffs (3)	Controlling for Exp.-Weighted Tariff Shocks (4)	Alternative Weights for Input Tariffs (5)	Differentiated vs Homog. Products (6)
$\Delta USTariff^{ADH8}_{i,t-1}$	-0.1714					
	(0.1670)					
$\Delta CHNInputTariff^{ADH8}_{i,t-1}$	0.2528					
	(0.2249)					
$\Delta USTariff_{i,t-1}$		-0.6013**	-0.5921**	-0.5751**		
		(0.2723)	(0.2647)	(0.2652)		
$\Delta CHNInputTariff_{i,t-1}$		0.5558	0.5433	0.5424		
		(0.5519)	(0.5550)	(0.5551)		
$\Delta CHNConsTariff_{i,t-1}$		-0.2695				
		(0.3098)				
$\Delta CHNExpWtdInputTariff_{i,t-1}$			-0.0633	-0.0705		
			(0.1296)	(0.1314)		
$\Delta CHNExpWtdConsTariff_{i,t-1}$				0.0496		
				(0.0702)		
$\Delta USTariff_{i,t-1}$					-0.5952**	
					(0.2677)	
$\Delta CHNInputTariff^{alt}_{i,t-1}$					0.6758	
					(0.5126)	
$\Delta USTariff_{i,t-1}$, Diff.						-0.7763***
						(0.2586)
$\Delta USTariff_{i,t-1}$, Homog.						-0.3053
						(0.4071)
$\Delta CHNInputTariff_{i,t-1}$, Diff.						0.8983
						(0.6223)
$\Delta CHNInputTariff_{i,t-1}$, Homog.						0.3368
						(0.7846)
Grid FE	Y	Y	Y	Y	Y	Y
Prefecture$\times$Year-Quarter FE	Y	Y	Y	Y	Y	Y
Grid $W_{i0}\times$Year-Quarter FE	Y	Y	Y	Y	Y	Y
Observations	669,845	669,845	669,845	669,845	669,845	669,845
F-stat	95.85	13.53	14.32	10.72	25.56	10.70

Back

Dep. Var.: $\Delta\ln(Light_{it})$	MFN Tariff (1)	Exchange Rate (2)	VAT (3)	All Policies (4)
$\Delta USTariff_{i,t-1}$	-0.5961**	-0.5970**	-0.5539**	-0.5723**
	(0.2706)	(0.2695)	(0.2546)	(0.2526)
$\Delta CHNInputTariff_{i,t-1}$	0.5495	0.5744	0.5195	0.5538
	(0.5562)	(0.5511)	(0.5619)	(0.5520)
$\Delta CHNMFNInputTariff_{i,t-1}$	-0.2598			-0.0657
	(0.5021)			(0.5488)
$\Delta ExportExRate_{i,t-1}$		-0.1284		-0.2056
		(0.1454)		(0.1694)
$\Delta ImportInputExRate_{i,t-1}$		-0.1619		-0.1629
		(0.1723)		(0.1813)
$\Delta ExportValAddTax_{i,t-1}$			1.0929	1.3712
			(0.9528)	(1.0768)
$\Delta ImportInputValAddTax_{i,t-1}$			-1.4104*	-1.1754
			(0.8231)	(0.8278)
Grid FE	Y	Y	Y	Y
Prefecture×Year×Quarter FE	Y	Y	Y	Y
Grid W_{i0}×Year×Quarter FE	Y	Y	Y	Y
Observations	669,845	669,845	669,845	669,845
F-stat	14.31	11.13	10.87	7.117

Back

	FE Model in Levels (1)	IVs for W_{i0} Grid Controls (2)	Interchange Google Maps & Amap (3)	Alternative Night Lights Measure (4)	Exclude Grids with Zero Population (5)	Two-Way Clustered SEs (6)
$USTariff_{i,t-1}$	-0.5236**					
	(0.2515)					
$CHNInputTariff_{i,t-1}$	0.4143					
	(0.5885)					
$\Delta USTariff_{i,t-1}$		-0.5949**	-0.6400*	-1.2920**	-0.5903**	-0.5903**
		(0.2707)	(0.3701)	(0.6084)	(0.2673)	(0.2625)
$\Delta CHNInputTariff_{i,t-1}$		0.5625	1.1291	1.3337	0.5509	0.5509
		(0.5548)	(0.7721)	(1.3794)	(0.5555)	(0.7061)
Grid FE	Y	Y	Y	Y	Y	Y
Prefecture×Year×Quarter FE	Y	Y	Y	Y	Y	Y
Grid W_{i0}×Year×Quarter FE	Y	Y	Y	Y	Y	Y
Observations	1,057,218	669,845	669,845	676,852	487,291	669,845
F-stat	19.83	1.681	34.57	21.22	21.22	10.20

Back

Dep. Var.: $\Delta\ln(Light_{it})$	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta USTariff_{i,t-1}$	-0.6878***	-0.7649***	-0.7761***	-0.7731***	-0.6609***	-0.5426**
	(0.1918)	(0.2027)	(0.2141)	(0.2099)	(0.1902)	(0.2614)
$\Delta USTariff_{i,t-1}$, <15km ring	-0.9945*				-0.8538	-0.1753
	(0.5329)				(0.5424)	(0.5162)
$\Delta USTariff_{i,t-1}$, 15-30km ring		-1.0611***			-0.8094*	-0.1592
		(0.3795)			(0.4335)	(0.4344)
$\Delta USTariff_{i,t-1}$, 30-50km ring			0.3686		0.4288	0.8396
			(0.8256)		(0.8183)	(0.7730)
$\Delta USTariff_{i,t-1}$, 50-100km ring				0.9406	0.6876	0.6269
				(1.1608)	(1.3275)	(1.2528)
$\Delta CHNInputTariff_{i,t-1}$	0.2505	0.1390	0.0260	0.1028	0.1728	0.4127
	(0.3286)	(0.3468)	(0.3190)	(0.3371)	(0.3342)	(0.6082)
$\Delta CHNInputTariff_{i,t-1}$, <15km ring	-1.2920**				-1.3886**	0.1414
	(0.6003)				(0.6421)	(0.5975)
$\Delta CHNInputTariff_{i,t-1}$, 15-30km ring		-1.6279			-1.4659	-0.3996
		(1.0309)			(1.0011)	(0.9093)
$\Delta CHNInputTariff_{i,t-1}$, 30-50km ring			-2.5693*		-2.7819**	-1.8007
			(1.2818)		(1.2457)	(1.1936)
$\Delta CHNInputTariff_{i,t-1}$, 50-100km ring				-0.2535	-1.9600	-1.3087
				(2.3900)	(2.5769)	(2.4970)
Grid FE	Y	Y	Y	Y	Y	Y
Prefecture×Year×Quarter FE	Y	Y	Y	Y	Y	Y
Grid W_{i0}×Year×Quarter FE	N	N	N	N	N	Y
Observations	669,845	669,845	669,845	669,845	669,845	669,845
F-stat	8.019	15.84	18.85	19.62	2.242	2.370

Back

$$\sum_{r=1}^{4} \frac{L_{r0} D_{ir}^{-\delta}}{\sum_{h=1}^{4} L_{h0} D_{ih}^{-\delta}} \Delta USTariff_{Ring_r(i),t},$$

Dep. Var.: $\Delta \ln(Light_{it})$	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta USTariff_{i,t-1}$	-0.7784**	-0.6802***	-0.5799**	-0.7736***	-0.8050***	-0.5639*
	(0.3562)	(0.1972)	(0.2700)	(0.2025)	(0.2342)	(0.2844)
Non-local $\Delta USTariff_{i,t-1}$, in 100km ring	-1.9421**	-1.6113**	-0.4112			
	(0.9492)	(0.6961)	(0.6529)			
Non-local $\Delta USTariff_{i,t-1}$, all prefectures				-3.4265	-0.7375	0.8142
				(2.5720)	(1.6426)	(1.5034)
$\Delta CHNInputTariff_{i,t-1}$	0.3579	0.2930	0.4915	0.1172	0.0978	0.5876
	(0.4117)	(0.3450)	(0.5755)	(0.3522)	(0.3108)	(0.5437)
Non-local $\Delta CHNInputTariff_{i,t-1}$, in 100km ring	-0.6879	-1.4408	0.6153			
	(1.6849)	(1.0455)	(0.8451)			
Non-local $\Delta CHNInputTariff_{i,t-1}$, all prefectures				2.8121	-0.4393	1.0919
				(4.0103)	(1.7915)	(1.8993)
Grid FE	Y	Y	Y	Y	Y	Y
Year-Quarter FE	Y	N	N	Y	N	N
Prefecture×Year-Quarter FE	N	Y	Y	N	Y	Y
Grid W_{i0}×Year-Quarter FE	N	N	Y	N	N	Y
Observations	652,345	652,345	652,345	669,845	669,845	669,845
F-stat	12.45	12.66	7.265	16.95	16.19	10.28

Back

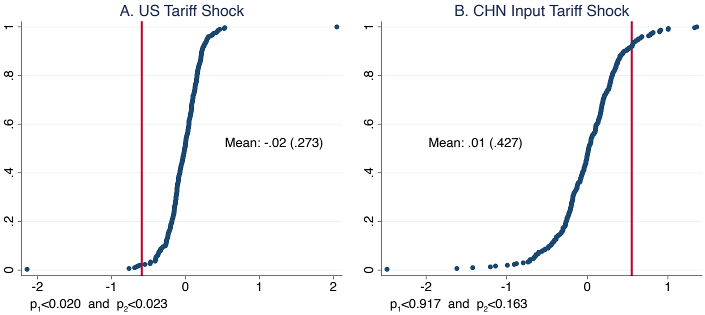
$$\sum_j \frac{L_{j0} D_{ij}^{-\delta}}{\sum_n L_{n0} D_{in}^{-\delta}} \Delta USTariff_{j(i),t},$$

$$\text{where } \Delta USTariff_{j(i),t} = \begin{cases} \sum_{p \in \mathcal{J}} \frac{L_{p0}}{\sum_{q \in \mathcal{J}} L_{q0}} \Delta USTariff_{p,t} & \text{if} \quad i \notin \mathcal{J} \\ \sum_{p \in \mathcal{J}, p \neq i} \frac{L_{p0}}{\sum_{q \in \mathcal{J}, q \neq i} L_{q0}} \Delta USTariff_{p,t} & \text{if} \quad i \in \mathcal{J} \end{cases}$$

Dep. Var.: $\Delta \ln(Light_{it})$	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta USTariff_{i,t-1}$	-0.7784**	-0.6802***	-0.5799**	-0.7736***	-0.8050***	-0.5639*
	(0.3562)	(0.1972)	(0.2700)	(0.2025)	(0.2342)	(0.2844)
Non-local $\Delta USTariff_{i,t-1}$, in 100km ring	-1.9421**	-1.6113**	-0.4112			
	(0.9492)	(0.6961)	(0.6529)			
Non-local $\Delta USTariff_{i,t-1}$, all prefectures				-3.4265	-0.7375	0.8142
				(2.5720)	(1.6426)	(1.5034)
$\Delta CHNInputTariff_{i,t-1}$	0.3579	0.2930	0.4915	0.1172	0.0978	0.5876
	(0.4117)	(0.3450)	(0.5755)	(0.3522)	(0.3108)	(0.5437)
Non-local $\Delta CHNInputTariff_{i,t-1}$, in 100km ring	-0.6879	-1.4408	0.6153			
	(1.6849)	(1.0455)	(0.8451)			
Non-local $\Delta CHNInputTariff_{i,t-1}$, all prefectures				2.8121	-0.4393	1.0919
				(4.0103)	(1.7915)	(1.8993)
Grid FE	Y	Y	Y	Y	Y	Y
Year-Quarter FE	Y	N	N	Y	N	N
Prefecture×Year-Quarter FE	N	Y	Y	N	Y	Y
Grid W_{i0}×Year-Quarter FE	N	N	Y	N	N	Y
Observations	652,345	652,345	652,345	669,845	669,845	669,845
F-stat	12.45	12.66	7.265	16.95	16.19	10.28

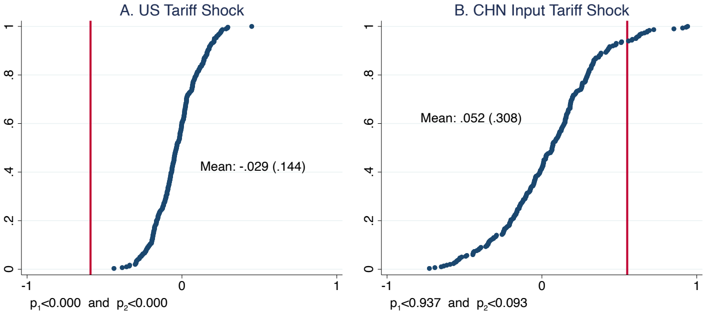
Back

Figure: Baseline Estimated Coefficients versus Placebo Coefficients (Reshuffling Trade Shares across Grids within Prefectures)



Notes: Panel A shows the cumulative distribution of the estimated coefficient of $\Delta USTariff_{i,t-1}$ when the regression specification from Column 4 of Table **??** is run on a series of 300 placebo grid samples. For each placebo grid, we randomly reshuffle the US and CHN input tariff shocks over our sample period (that are associated with the same grid cell) across grids within a prefecture. The mean of the $\Delta USTariff_{i,t-1}$ coefficient estimate across the 300 placebo grids is -0.020, and the standard deviation is 0.273; for comparison, the vertical line indicates the coefficient estimate obtained from the actual sample. Panel B illustrates the analogous cumulative distribution of the coefficient estimates of $\Delta CHNInputTariff_{i,t-1}$ across the 300 placebo grids. The mean of these coefficient estimates is 0.010, and the standard deviation is 0.427. Under each graph, two summary statistics are presented: p_1 is the fraction of placebo coefficient estimates that have a more negative value compared to the estimates obtained from the actual sample, and p_2 is the fraction with larger absolute values.

Figure: Baseline Estimated Coefficients versus Placebo Coefficients (Reshuffling Product-Level Shifters)



Notes: Panel A shows the cumulative distribution of the estimated coefficient of $\Delta USTariff_{i,t-1}$ when the regression specification from Column 4 of Table **??** is run on a series of 300 placebo grid samples. For each placebo grid, we build shift-share measures of the US and CHN input tariff shocks by combining actual grid trade shares for each of the HS 6-digit products with product-level shifters that are reshuffled. The mean of the $\Delta USTariff_{i,t-1}$ coefficient estimate across the 300 placebo grids is -0.029, and the standard deviation is 0.144; for comparison, the vertical line indicates the coefficient estimate obtained from the actual sample. Panel B illustrates the analogous cumulative distribution of the coefficient estimates of $\Delta CHNInputTariff_{i,t-1}$ across the 300 placebo grids. The mean of these coefficient estimates is 0.052, and the standard deviation is 0.308. Under each graph, two summary statistics are presented: p_1 is the fraction of placebo coefficient estimates that have a more negative value compared to the estimates obtained from the actual sample, and p_2 is the fraction with larger absolute values.

Back

Dep. Var.: $\Delta\ln(Light_{it})$	(1) FE estimator	(2) DID_{M}	(3) FE estimator	(4) DID_{M}
$\Delta ExportTariff^{d}_{i,t-1}$	-0.3477***	-0.4519***		
	(0.1186)	(0.1814)		
$\Delta InputTariff^{d}_{i,t-1}$			-0.1800	-0.1604
			(0.1078)	(0.2264)
Grid FE	Y	Y	Y	Y
Prefecture×Quarter×Year FE	Y	Y	Y	Y
Observations	669,845	669,845	669,845	669,845

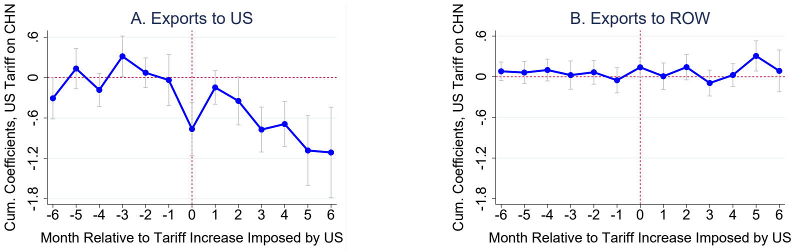
Back

Dep. Var.: $\Delta \ln(Light_{it})$ Measure of Commuting Openness:	(1) $1-\lambda^R_{cc\|c}$	(2) $1-\lambda^L_{cc\|c}$
Commuting Openness$_c$: above medium $\times$ $\Delta USTariff_{i,t-1}$	-0.7392**	-0.7463**
	(0.2691)	(0.2822)
Commuting Openness$_c$: below medium $\times$ $\Delta USTariff_{i,t-1}$	0.0069	-0.1033
	(0.3783)	(0.2996)
Commuting Openness$_c$: above medium $\times$ Non-local $\Delta USTariff_{i,t-1}$, in 100km ring	-0.0683	-0.0858
	(0.7384)	(0.7246)
Commuting Openness$_c$: below medium $\times$ Non-local $\Delta USTariff_{i,t-1}$, in 100km ring	-1.6918*	-1.4077*
	(0.9610)	(0.7176)
Commuting Openness$_c$: above medium $\times$ $\Delta CHNInputTariff_{i,t-1}$	0.4973	0.7727
	(0.5108)	(0.5105)
Commuting Openness$_c$: below medium $\times$ $\Delta CHNInputTariff_{i,t-1}$	-0.7903	-1.2290
	(1.8671)	(1.1369)
Commuting Openness$_c$: above medium $\times$ Non-local $\Delta CHNInputTariff_{i,t-1}$, in 100km ring	-0.0426	0.2996
	(0.8551)	(0.9182)
Commuting Openness$_c$: below medium $\times$ Non-local $\Delta CHNInputTariff_{i,t-1}$, in 100km ring	4.1898**	1.9927
	(1.8063)	(1.2844)
Grid FE	Y	Y
Prefecture$\times$Year-Quarter FE	Y	Y
Grid $W_{i0}\times$Year-Quarter FE	Y	Y
Observations	343,201	343,201
F-stat	2.918	3.830

Back

Cumulative Effects of US Tariffs on Export Flows

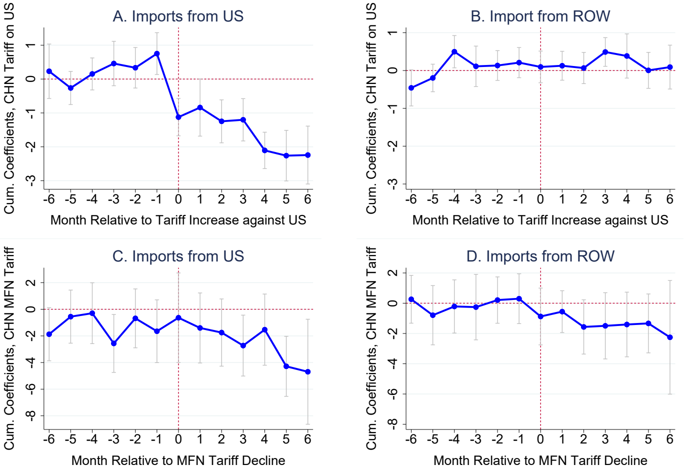
$$\Delta \ln X_{kt} = \sum_{\tau=-6}^{\tau=6} \varphi^{\tau} \Delta USTariff_{k,t-\tau} + D_k + D_{st} + \varepsilon^{X}_{kt}$$



Back

Cumulative Effects of China's Tariffs on Import Flows

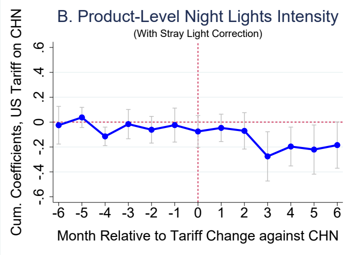
$$\Delta \ln M_{kt} = \sum_{\tau=-6}^{\tau=6} \theta_1^{\tau} \Delta ImportTariff_{k,t-\tau}^{US} + \sum_{\tau=-3}^{\tau=6} \theta_2^{\tau} \Delta ImportTariff_{k,t-\tau}^{MFN} + D_k + D_{st} + \varepsilon_{kt}^{M}$$

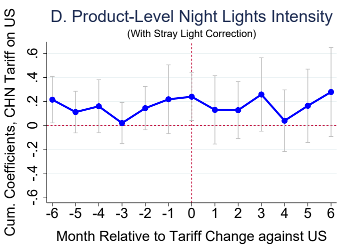


Cumulative Effects of Tariff Shocks on Night Lights

$$\Delta \ln(Light^{X}_{kt}) = \sum_{\tau=-6}^{\tau=6} \delta^{\tau} \Delta USTariff_{k,t-\tau} + D_k + D_{st} + \nu^{X}_{kt}$$

$$\Delta \ln(Light^{M}_{kt}) = \sum_{\tau=-6}^{\tau=6} \kappa^{\tau} \Delta ImportTariff^{US}_{k,t-\tau} + D_k + D_{st} + \nu^{M}_{kt}$$

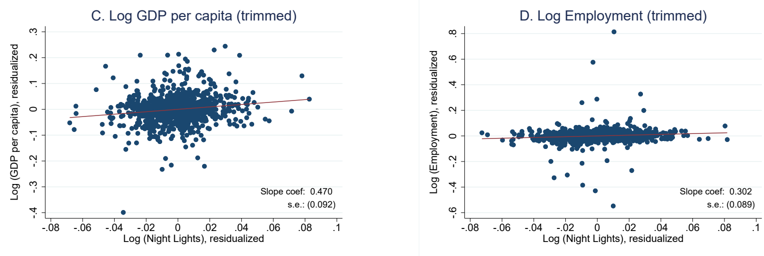




Notes: Product-level measure of the grid-level outcome (y_{it}) is: $y_{kt} = \frac{\sum_i e_i s_{ik} y_{it}}{\sum_i (e_i s_{ik})}$.

Back

Figure: GDP per capita, Employment, and Night Lights Intensity at the Prefecture Level



Back

Mapping Night Lights to Economic Activity

Table: GDP and Night Lights Intensity
Cross-Country Panel Data (1993-2010)

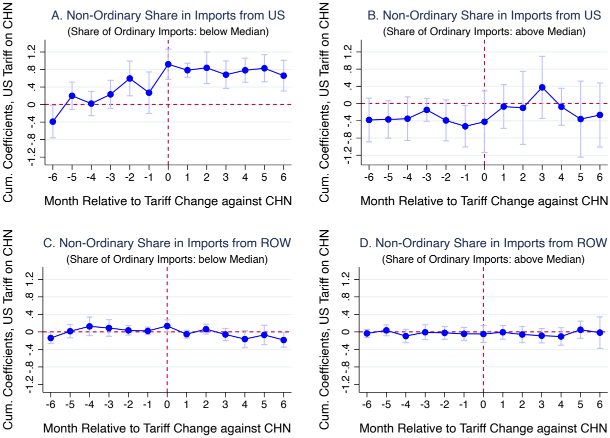
Dep. Var.: ln($GDPpc_{ct}$)	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS
ln($Light_{ct}$)	0.2898***	0.2927***	0.2585***	0.3943***	0.4061***	0.3666***	0.3875***
	(0.0520)	(0.0524)	(0.0498)	(0.0661)	(0.0648)	(0.0591)	(0.1079)
Observations	2,567	2,538	2,347	2,567	2,538	2,347	2,347
R-squared	0.9919	0.9922	0.9939	—	—	—	—
F-stat	—	—	—	126.7	119.6	83.39	236.8
Year FE	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y
Trimmed	N	Tail 1%	Tail 5%	N	Tail 1%	Tail 5%	Tail 5%
Weighted by population	N	N	N	N	N	N	Y

- Data from Pinkovskiy and Sala-i-Martin (2016). The satellite data is obtained from the DMSP-OLS (which is top coded).

Cumulative Effects of Tariff Shocks on Non-Ord Imports

$$\frac{M_{km}^{US,NonOrd}}{M_{km}^{US}} = \sum_{\tau=-6}^{\tau=6} \lambda_1^{\tau} \Delta CHNInputTariff_{k,m+\tau} + \sum_{\tau=-6}^{\tau=6} \lambda_2^{\tau} \Delta CHNMFNInputTariff_{k,m+\tau} + D_k + D_{sm} + \varepsilon_{km},$$

Back



Estimation of $1/\beta$: Alternative Aggregation Level

Table: GDP and Night Lights Intensity:
County- or Province-Level Analysis (2012-2016)

Dep. Var.: $\Delta \ln(GDPpc_{js})$	County-Level		Province-Level	
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
$\ln(Light_{js})$	0.5384**	0.4003**	$0.4004^{\dagger}$	$0.3574^{\dagger}$
	(0.2192)	(0.1692)	(0.2521)	(0.2396)
Province×Year FE	Y	Y	N	N
County FE	Y	Y	N	N
Year FE	N	N	Y	Y
Province FE	N	N	Y	Y
Trimmed	N	Tail 5%	N	Tail 5%
Observations	8,167	7,533	124	118
F-stat	3.546	3.522	4.112	4.509

Back

Other Benchmarks for $1/\beta$

- Henderson et al. (2012), based on cross-sectional long difference of country GDP (not GDP per capita): 0.58 to 0.97
- Hu and Yao (2021), based on annual growth rates of country GDP: 0.77
- Beyer, Hu and Yao (2021), based on growth rates of country GDP with quarterly frequency: 0.64
- Storeygard (2016), based on cross-sectional long difference of Chinese prefecture GDP: 0.25

Back