The Unintended Consequences of Trade Protection on the Environment

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Bank of Estonia Research Seminar, November 9, 2023

Outline

1. Introduction
2. Data and Identification Strategy
3. Results
    - Trade Protection and Environmental regulation
    - Robustness Checks
    - Political Incentives and Environmental Regulation in China
    - Conclusion
4. Appendix

Outline

Motivation

- **Politically-motivated** changes in economic policies are an essential determinant of **macroeconomic fluctuations** (Nordhaus, 1975)
- Political leaders are opportunistic and aim to hold office ⇒ Incentives to implement policies to boost the business cycle and promote **political stability** (Acemoglu and Robinson, 2004)
- Political cycles are documented for several policy tools (taxes, monetary policy, etc.), but there is no systematic evidence for **environmental regulation** (e.g., Alesina et al., 1997; Drazen, 2000)

Motivation

- **Anecdotal evidence** suggests that politicians can use environmental policies to smooth a negative shock to the business cycle. For example:
  - In June 2020, President Trump signed an executive order to waive long-standing environmental laws in the aftermath of the outbreak of the COVID-19 crisis
  - In the aftermath of the War in Ukraine, Germany reactivated coal-fired power plants temporarily recourse to coal despite the commitment of the coalitions to wind down coal usage by 2030
  - During the US-China trade war, Chinese officials have publicly declared that China's greenhouse gas emission targets are at risk as "the country has to take more measures to guarantee employment and the people's livelihood"

This Paper

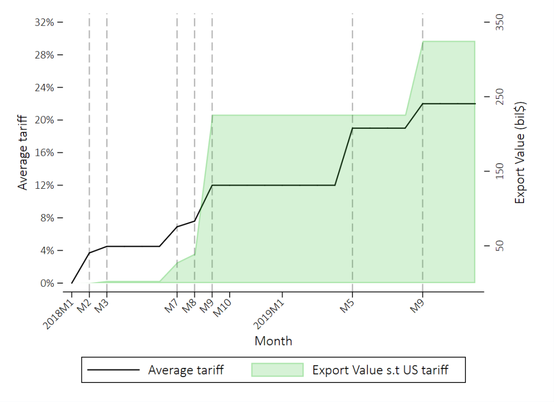
- We analyze the impact of **trade protection** on the environment using the 2018 US-China trade war as a quasi-natural experiment

- We find that tariff exposure leads to an easing of **environmental regulation** and a rise in **air pollution** in China

⇒ Governments' response to trade shocks is key to analyze the impact of trade protection on the environment

Motivation

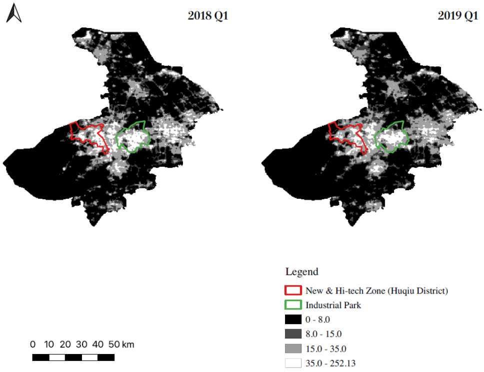
The US-China Trade War



Source: Authors' calculations based on tariff data from Fajgelbaum et al. (2020)

Motivation

The US-China Trade War and Chinese Production

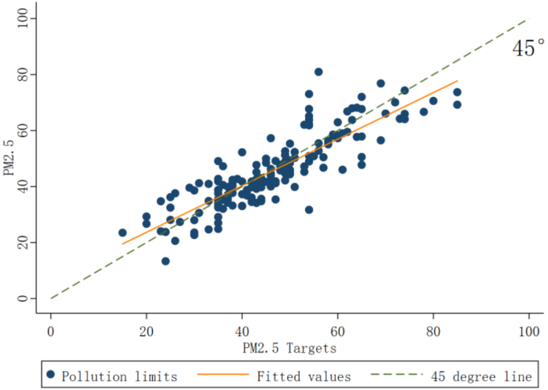


Night Lights Intensity in Suzhou in Q1/2018 and Q1/2019. Source: Chor and Li (2021)

Environmental Regulation in China

- Complex **governance** with shared competences between the central government and the local administrations (He et al., 2020)
- The central government assigns abatement requirements to each province
- Provincial governors further assign additional targets to prefecture and county leaders
- The success in achieving environmental goals becomes a criterion for the **promotion** of local politicians (Khan et al., 2015)

Regulation and Pollution in China After 2018



Source: Authors' calculations.

Related Literature

- **Political Economy of Environmental Regulation**: Conconi (2003), List and Sturm (2006), Burgess et al. (2012), Zheng et al. (2014), Kahn et al. (2015), Chen et al. (2018), He et al. (2020)
- **Trade Policy and Pollution**: Cherniwchan (2017a), Cherniwchan (2017b), Shapiro and Walker (2018), Bombardini and Li (2020), Copeland et al. (2021)
- **Trade Policy and Enviromental Regulation**: Markusen (1975), Copeland and Taylor (1994, 1995), Elliott et al. (2010), Battaglini and Harstad (2016, 2020), Fowlie et al. (2016), Shapiro (2020)
- **US-China Trade War**: Amiti et al. (2019), Cavallo et al. (2019), Flaaen and Pierce (2019), Lin et al. (2019), Fajgelbaum et al. (2020), Flaaen et al. (2020), Chor and Li (2021)

Outline

Tariff and Trade Data

- **Trump Tariffs** at HS6 level are provided by Fajgelbaum et al. (2020)
- Chinese **exports** to the United States are retrieved from the Chinese Custom Database
- Our sample period covers from 2015 to 2020

Environmental Data

- Daily **air quality** data were collected from the records of 1,650 local monitoring stations
- Environmental regulation **targets** at prefecture level is hand-collected by directly contacting Chinese officials by phone or email
- Environmental regulation **restrictiveness** is also retrieved from the Prefectures' Annual Work Reports
- Environmental regulation **enforcement** is measured by using a database on environmental penalties to Chinese firms collected by the Beijing University Law School

Identification Strategy

- Following Bombardini and Li (2020) and Handley et al. (2020), we adopt a Bartik research design to measure the prefecture's exposure to tariffs:

$$\Delta\tau_p = \sum_{i \in I_p} \frac{Export^{US}_{ip,2015}}{Export_{ip,2015}} \Delta\tau_i \tag{1}$$

- We identify the **causal impact** of the US tariffs on local air pollution in China by using the US-China trade war as a quasi-natural experiment

▸ Tariff Exposure

Descriptive Statistics

Variable	(1) Observations	(2) Mean	(3) SD	(4) p10	(5) p50	(6) p90
PANEL A: Tariff Exposure						
$\Delta\tau_p$	291	20.10	21.21	0.745	13.01	47.96
PANEL B: Air Pollution Measures						
$PM_{2.5}$	1,748	43.00	24.34	18.96	36.61	75.03
PM_{10}	1,748	75.35	37.22	36.87	67.49	126.1
PANEL C:Regulation						
$PM_{2.5}$ Target	995	45.08	12.76	30	43	63
PM_{10} Target	408	81.44	21.39	56	78	111.4
Penalties	1,503	3.774	1.726	1.386	3.850	5.900
Penalties Share	1,485	-2.995	1.518	-4.958	-2.882	-1.199
Count	1,712	1.246	0.964	0.0953	1.411	2.092
Share	1,693	-2.859	1.386	-3.819	-2.632	-1.927

Identification Strategy

- We first estimate the following **event-study** regression:

$$\text{Regulation}_{pt} = \beta_0 + \sum_{t=-T}^{T} \beta_1^t \Delta\tau_p \times I_{(t \geq 2018)} + \beta_p + X_p \times \beta_t + \beta_r \times \beta_t + \epsilon_{pt}, \quad (2)$$

- We then estimate the following **diff-in-diff** model:

$$\text{Regulation}_{pt} = \alpha_0 + \alpha_1 \Delta\tau_p \times I_{(t \geq 2018)} + \alpha_p + X_p \times \alpha_t + \alpha_r \times \alpha_t + \epsilon_{pt} \quad (3)$$

- The year 2018 is the **benchmark year** where the tariff shock is realized

Identification Strategy

Identification Assumptions

- We identify the causal impact of trump tariffs on environmental outputs if:

$$\mathbb{E}\left(\Delta\tau_p \times I_{(t\geq t_0)}, \epsilon_{pt} \middle| W_p\right) \neq 0 \qquad (4)$$

- Thus we assume that:

1. Prefectures are (conditionally) randomly exposed to Trump tariffs
2. Industries are (conditionally) randomly exposed to Trump tariffs
3. The timing of the US-China trade war is exogenous

Identification Strategy

Identification Assumptions

- Non-random exposure of prefectures to tariffs ⇒ we include the following controls (× Year FE): distance to the nearest port, total export by SOEs, total export to the US before the trade war, the sum of export share at prefecture level (à la Borusyak et al., 2022)
- Non-random exposure of industries to tariffs ⇒ we include as a control (× Year FE) the prefecture's total export value in these targeted industries before the trade war (Lu et al., 2017)
- Non-random timing of the trade war ⇒ We control for year FE + previous years pollution

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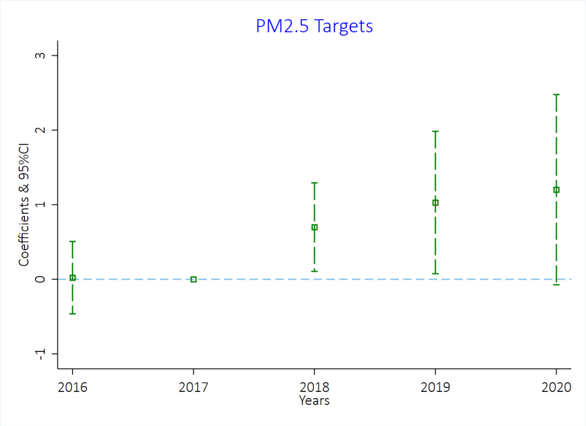
Trade War and Environmental Regulation in China

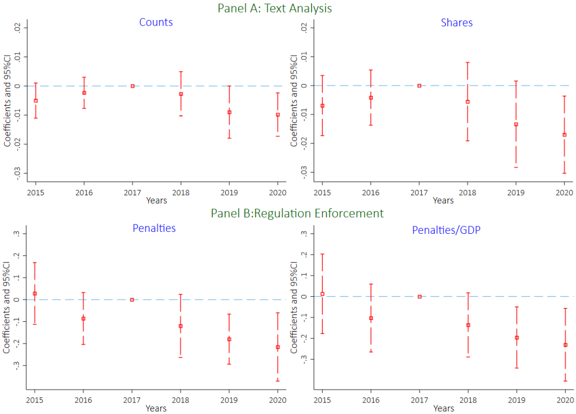
Event Study - Pollution Target



GDP Target

Trade War and Environmental Regulation in China

Event Study - Enforcement



US Import Tariffs and Environmental Regulation

DiD Estimates

	(1) $\overline{\text{PM}}_{2.5,p,t}$	(2) $\text{Count}_{p,t}$	(3) $\text{Share}_{p,t}$	(4) $\text{Penalties}_{p,t}$	(5) Penalties $\text{Share}_{p,t}$
$\Delta\tau_p \times I_{(t\geq 2018)}$	1.140***	-0.011**	-0.006**	-0.149***	-0.139**
	(0.151)	(0.007)	(0.003)	(0.052)	(0.054)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	887	1411	1411	1156	1156
R^2	0.972	0.451	0.441	0.785	0.695

1 s.d. change in $\Delta\tau_p \Rightarrow \uparrow \overline{\text{PM}}_{2.5,p,t}$ by 62% (115% of its s.d.)

1 s.d. change in $\Delta\tau_p \Rightarrow \downarrow$ in $\text{Penalties}_{p,t}$ by 69% (133% of its s.d.)

1 s.d. change in $\Delta\tau_p \Rightarrow \downarrow$ in $\text{Share}_{p,t}$ by 5% (16% of its s.d.)

Outline

Shift-Share Research Design and Exogeneity

- We measure the exposure to the trade war following Bartik (1991) $\Rightarrow$ The shares (the export shares) and the shifters (the changes in US tariffs) are exogenous
- Borusyak et al. (2021) develop a new framework to ensure the parameters' consistency by only assuming the exogeneity of the shocks
- Following Borusyak et al. (2021), we estimate a product-level (HS6) regression:

$$\text{Regulation}_{it}^{\perp} = \gamma_0 + \gamma_1 \Delta\tau_i^{\perp} \times I_{(t \geq 2018)} + \gamma_i + \gamma_t + \epsilon_{it}^{\perp} \quad (5)$$

Shift-Share Research Design and Exogeneity

	(1) $\overline{\text{PM}}^{\perp}_{2.5,i,t}$	(2) $\text{Count}^{\perp}_{i,t}$	(3) $\text{Share}^{\perp}_{i,t}$	(4) $\text{Penalties}^{\perp}_{i,t}$	(5) Penalties $\text{Share}^{\perp}_{i,t}$
$\Delta\tau_i^{\perp} \times I_{(t\geq 2018)}$	0.965***	-0.052**	-0.124***	-0.113**	-0.100*
	(0.189)	(0.021)	(0.039)	(0.057)	(0.057)
Product FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
N	17,111	17,896	17,896	17,896	17,896
R^2	0.003	0.000	0.001	0.001	0.000

Other Robustness Checks

- Placebo test using 2017 as year of the treatment ▸ Placebo
- Falsification test by constructing the shares using exports to the EU ▸ Falsification
- Dropping the year 2020 because of COVID-19 ▸ COVID19
- Dropping each sector in our baseline ▸ Drop Sectors

US Import Tariffs and Local Air Pollution in China

DID Estimates

	(1)	(2)	(3)
	$PM_{2.5,p,t}$	$PM_{10,p,t}$	$CO_{2,p,t}$
$\Delta\tau_p \times I_{(t\geq 2018)}$	0.006**	0.007**	0.005**
	(0.002)	(0.002)	(0.002)
Prefecture FE	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes
Control	No	Yes	Yes
2020 Included	No	Yes	No
Observations	1,453	1,453	1,121
adj. R^2	0.974	0.974	0.993

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Chinese Political Economy and Institutions

General Framework

Chinese politicians have incentives to manipulate environmental regulation to boost production for three reasons:

- Chinese politicians have incentives to promote **social stability** (Wen, 2020)
- Environmental regulation is very **costly** for Chinese firms (He et al., 2020)
- A large share of Chinese **SOEs** is concentrated in polluting industries (Wang and Jin, 2007)

Chinese Political Economy and Institutions

Political Incentives for Local Politicians

- Politicians' performance at local level is key for **promotion** in the leadership of the CCP
- From the 14th Party Congress (1992) to the 19th Party Congress (2017) about 65% of Politburo members had served as provincial/municipal secretary and/or governor/mayor (Joseph, 2019)
- Promotion or termination of provincial leaders is a function of **local economic performance** (Li and Zhou, 2005; Campante et al., 2019)

Chinese Political Economy and Institutions

Trade War, Environmental Regulation, and Political Incentives

	(1)	(2)	(3)	(4)
	$PM_{2.5,p,t}$	$PM_{2.5,p,t}$	$PM_{2.5,p,t}$	$PM_{2.5,p,t}$
$\Delta\tau_p \times I_{(t\geq 2018)}$	1.140***	1.179***	1.092***	1.055***
	(0.151)	(0.139)	(0.179)	(0.132)
$\Delta\tau_p \times I_{(t\geq 2018)} \times I_{age\leq 56,p}$		0.014**		
		(0.004)		
$\Delta\tau_p \times I_{(t\geq 2018)} \times I_{year\leq 3,p}$			0.017*	
			(0.008)	
$\Delta\tau_p \times I_{(t\geq 2018)} \times I_{connect,p}$				0.032***
				(0.006)
N	887	887	887	887
R^2	0.972	0.971	0.962	0.972

Chinese Political Economy and Institutions

Trade War, Environmental Regulation, and Economic Performance

	(1) $GDP_{p,t}$	(2) $GDP_{p,t}$	(3) $GDP_{p,t}$	(4) $GDP_{p,t}$	(5) $GDP_{p,t}$
$\Delta_p \times I_{t \geq t_0}$	-0.014*	-0.015**	-0.017**	-0.016**	-0.015*
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)
$\Delta_p \times I_{t \geq t_0} \times I_{40\%,p}$		0.001			
		(0.001)			
$\Delta_p \times I_{t \geq t_0} \times I_{30\%,p}$			0.002*		
			(0.001)		
$\Delta_p \times I_{t \geq t_0} \times I_{20\%,p}$				0.003**	
				(0.001)	
$\Delta_p \times I_{t \geq t_0} \times I_{10\%,p}$					0.003***
					(0.001)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	1148	1148	1148	1148	1148
R^2	0.972	0.972	0.972	0.972	0.972

Chinese Political Economy and Institutions

Trade War, Environmental Regulation, and Political Careers

	(1) Promotion$_{p,t}$	(2) Promotion$_{p,t}$	(3) Promotion$_{p,t}$	(4) Promotion$_{p,t}$	(5) Promotion$_{p,t}$
$\Delta_p \times I_{t \geq t_0}$	-0.021*	-0.011	-0.011	-0.011	-0.011
	(0.008)	(0.014)	(0.014)	(0.014)	(0.014)
$\Delta_p \times I_{t \geq t_0} \times I_{40\%,p}$		0.000			
		(0.001)			
$\Delta_p \times I_{t \geq t_0} \times I_{30\%,p}$			0.002		
			(0.001)		
$\Delta_p \times I_{t \geq t_0} \times I_{20\%,p}$				0.000	
				(0.001)	
$\Delta_p \times I_{t \geq t_0} \times I_{10\%,p}$					0.003**
					(0.001)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	1155	1155	1155	1155	1155
R^2	0.291	0.310	0.311	0.310	0.312

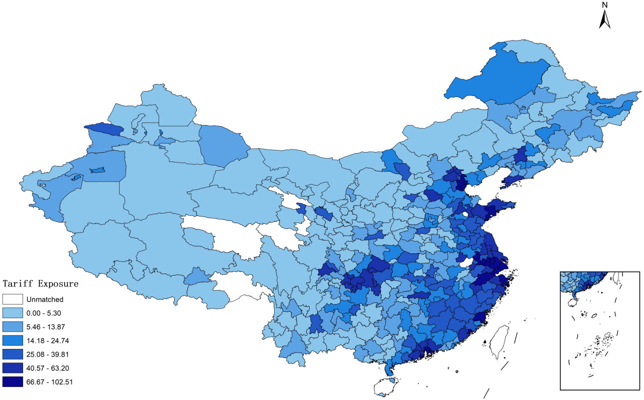
Outline

Conclusion

- We show that **trade protection** negatively affects **environmental regulation** and **local air pollution**
- Our results support the importance of "deep" trade integration $\Rightarrow$ A unilateral tariff increase might lead to undesirable environmental outcomes
- This evidence casts doubts on the **political feasibility** of trade policy reforms aiming to tackle carbon emissions (Shapiro, 2020)

Thank you!

Tariff Exposure Across Chinese Prefectures



Source: Authors' calculations.

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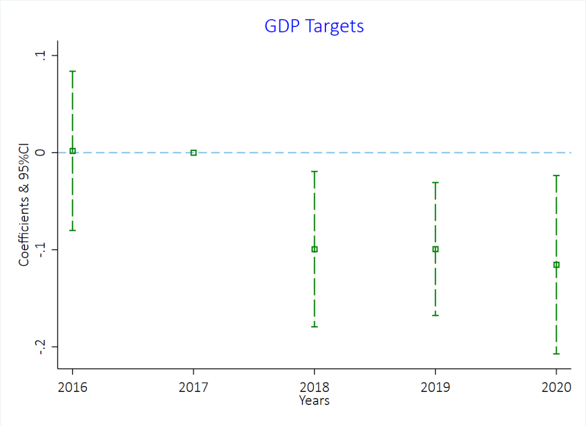
Trade War and Environmental Regulation in China

Event Study - Pollution Target



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Placebo Test

	(1) $\overline{\text{PM}}_{2.5,p,t}$	(2) $\text{Count}_{p,t}$	(3) $\text{Share}_{p,t}$	(4) $\text{Penalties}_{p,t}$	(5) Penalties $\text{Share}_{p,t}$
$\Delta\tau_p \times I_{(t\geq 2017)}$	-0.659	-0.000	-0.002	0.043	0.040
	(0.112)	(0.918)	(0.791)	(0.519)	(0.566)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	886	1411	1411	1156	1149
R^2	0.970	0.444	0.453	0.804	0.715

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Falsification Test

	(1)	(2)	(3)	(4)	(5)
	$\overline{\text{PM}}_{2.5,p,t}$	$\text{Count}_{p,t}$	$\text{Share}_{p,t}$	$\text{Penalties}_{p,t}$	Penalties $\text{Share}_{p,t}$
$\Delta\tau_p \times I_{(t\geq 2018)}$	0.473	0.055	0.055	-0.007	-0.004
	(0.317)	(0.007)	(0.004)	(0.062)	(0.066)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	692	1125	1125	917	917
R^2	0.976	0.455	0.471	0.814	0.730

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Excluding 2020

	(1)	(2)	(3)	(4)	(5)
	$\overline{\text{PM}}_{2.5,p,t}$	$\text{Count}_{p,t}$	$\text{Share}_{p,t}$	$\text{Penalties}_{p,t}$	Penalties $\text{Share}_{p,t}$
$\Delta\tau_p \times I_{(t\geq 2018)}$	1.060***	-0.136***	-0.129**	-0.008*	-0.014**
	(0.182)	(0.048)	(0.049)	(0.005)	(0.007)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes
2020 Included	No	No	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	692	917	917	1125	1125
R^2	0.976	0.814	0.730	0.471	0.455

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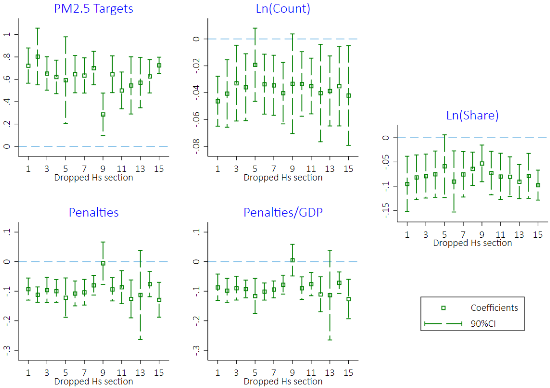
Trade War and Environment Regulation in China

Robustness Check: Dropping Sectors



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