

# Environmental Political Business Cycles The Case of PM2.5 Air Pollution in Chinese Prefectures

Xun Cao  
Penn State University

Genia Kostka  
Hertie School of Governance, Berlin

Xu Xu  
Penn State University

Paper prepared for the 2015 APSA Annual Meeting at San Francisco,  
September 3-6, 2015.

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Motivations

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Explaining environmental outcomes, but moving from cross-country to within country variation:

- need new theories: existing theories in IR and CP often focus on country level political institutions  $\Rightarrow$  e.g., political regime types, electoral rules, and corporatist institutions;
- need better, spatially disaggregated data: exceptions in IR and CP  $\Rightarrow$  Zeng and Eastin 2007; Bernauer and Koubi 2009.

# Motivations

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Explaining environmental outcomes, but moving from cross-country to within country variation:

- need new theories: existing theories in IR and CP often focus on country level political institutions  $\Rightarrow$  e.g., political regime types, electoral rules, and corporatist institutions;
- need better, spatially disaggregated data: exceptions in IR and CP  $\Rightarrow$  Zeng and Eastin 2007; Bernauer and Koubi 2009.

We focus on political business cycles:

- in authoritarian states;
- at sub-national level;
- looking at environmental impacts;

# Motivations

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Explaining environmental outcomes, but moving from cross-country to within country variation:

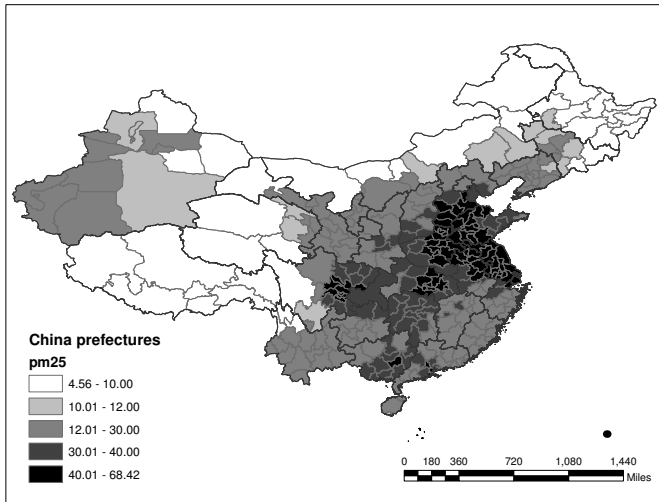
- need new theories: existing theories in IR and CP often focus on country level political institutions  $\Rightarrow$  e.g., political regime types, electoral rules, and corporatist institutions;
- need better, spatially disaggregated data: exceptions in IR and CP  $\Rightarrow$  Zeng and Eastin 2007; Bernauer and Koubi 2009.

We focus on political business cycles:

- in authoritarian states;
- at sub-national level;
- looking at environmental impacts;

We use China as an example here.

# Chinese prefectures, 2001



Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Intuitions

Why political business cycles in local Chinese politics?

Political business cycles are often driven by popular elections in democratic regimes as office-seeking governments are expected to pursue expansionary *monetary* and *fiscal* policies before and during election years in order to win elections (Alt and Lassen 2006).

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Intuitions

Why political business cycles in local Chinese politics?

Political business cycles are often driven by popular elections in democratic regimes as office-seeking governments are expected to pursue expansionary *monetary* and *fiscal* policies before and during election years in order to win elections (Alt and Lassen 2006).

Do we observe political business cycles without elections?

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Intuitions

Why political business cycles in local Chinese politics?

Political business cycles are often driven by popular elections in democratic regimes as office-seeking governments are expected to pursue expansionary *monetary* and *fiscal* policies before and during election years in order to win elections (Alt and Lassen 2006).

Do we observe political business cycles without elections? Yes.

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides



# Intuitions

Why political business cycles in local Chinese politics?

Political business cycles are often driven by popular elections in democratic regimes as office-seeking governments are expected to pursue expansionary *monetary* and *fiscal* policies before and during election years in order to win elections (Alt and Lassen 2006).

Do we observe political business cycles without elections? Yes.

E.g., Guo 2009:

- Chinese county level party secretaries accelerate government spending at the crucial point in the career path when upper level officials are about to make personnel decisions;
- ⇒ an inverted U-shaped relationship between local government expenditure growth and cadre's year in office;
- ⇒ expenditure growth peaks at the third or fourth year given a five term.

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# incentive structures

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Political tournaments theory: oversimplified version ...

- local officials motivated to maximize their chances of promotion;
- central/upper-level government decides promotion by evaluating the performance of local officials based on the relative economic growth of the jurisdictions;

# incentive structures

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Political tournaments theory: oversimplified version ...

- local officials motivated to maximize their chances of promotion;
- central/upper-level government decides promotion by evaluating the performance of local officials based on the relative economic growth of the jurisdictions;

⇒ Local official: just grow your local economy!

# political tournaments theory modified

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

an unrealistic assumption?  $\Rightarrow$  central/upper government able to identify local leaders' true ability despite a considerable amount of noises associated with GDP growth rates, e.g., exogenous shocks, differences in factor endowments, historical legacies ...

# political tournaments theory modified

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

an unrealistic assumption?  $\Rightarrow$  central/upper government able to identify local leaders' true ability despite a considerable amount of noises associated with GDP growth rates, e.g., exogenous shocks, differences in factor endowments, historical legacies ...

In reality, officials from an upper level government:

- do not have sufficient time and resources to fully investigate;
- facing information asymmetries;
- discount past performances;

# political tournaments theory modified

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

an unrealistic assumption?  $\Rightarrow$  central/upper government able to identify local leaders' true ability despite a considerable amount of noises associated with GDP growth rates, e.g., exogenous shocks, differences in factor endowments, historical legacies ...

In reality, officials from an upper level government:

- do not have sufficient time and resources to fully investigate;
- facing information asymmetries;
- discount past performances;

Local official: be strategic and “shine” at the right moment.

# shine at the right moment

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Local leaders should rationally produce political business cycles to signal competence when upper level party committee members are looking for signals of competence.

Not too early not too late: the years leading to the turnover year.

# environmental impacts

Motivation  
and Intuitions

**Theory**

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Direct impacts:

- GDP growth and scale effect;
- infrastructure investments and pollution;

More hidden:

- lessening implementation of environmental regulations lowers production costs of local firms to increases local GDP;
- if firms are mobile, jurisdictions with lower environmental regulations should attract pollution intensive firms;



# environmental impacts

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Direct impacts:

- GDP growth and scale effect;
- infrastructure investments and pollution;

More hidden policy instruments:

- lessening implementation of environmental regulations  $\Rightarrow$  lower production costs of local firms  $\Rightarrow$  increases local GDP;
- if firms are mobile, jurisdictions with lower environmental regulations should attract pollution intensive firms;

# theoretical expectation

Motivation  
and Intuitions

**Theory**

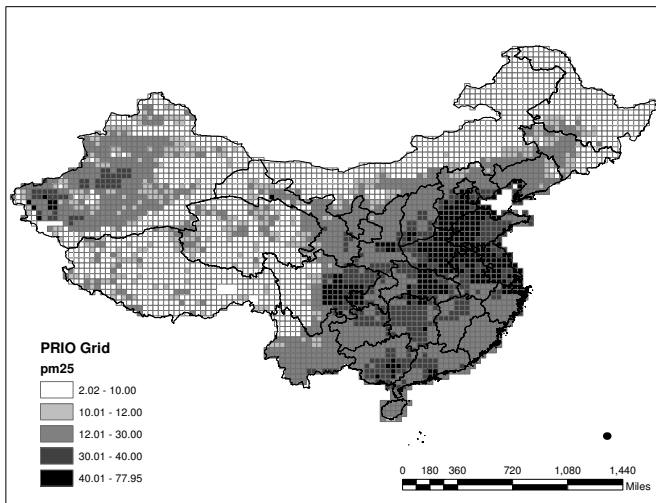
Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Hypothesis: we expect to see an environmental political business cycle in which years leading to the formal turnover year of prefecture party secretaries are associated with higher level of PM2.5 pollution.

# Chinese grid-cells, 2001



Motivation  
and Intuitions

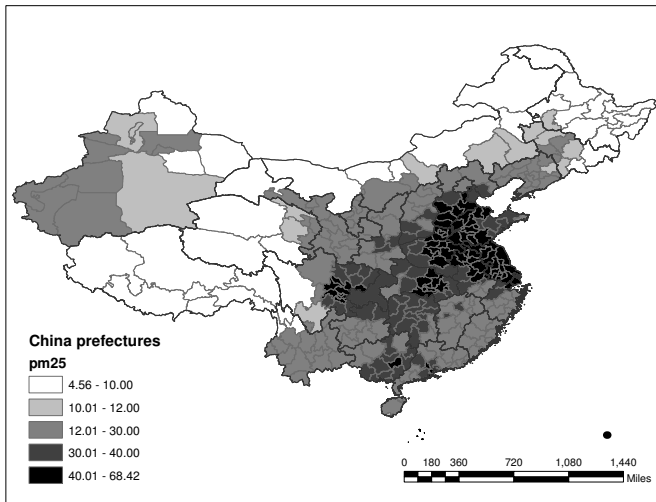
Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Chinese prefectures, 2001



Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# model specifications

Unit of analysis: about 333 prefecture-level divisions, 2002-2010;

key explanatory variables: for a party secretary

- year before turnover
- year in office and its square term
- second term

Many control variables:

- time variant: GDP per capita (and its square term), GDP growth, road density, ...
- time invariant: distance to Beijing, distance to provincial capital, elevation, ...

random and fixed effects models, year fixed effects, clustered standard error or AR1 ...

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# empirical results

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

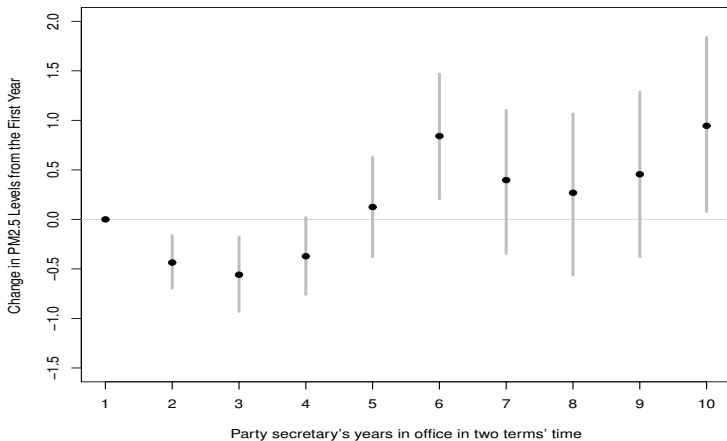
Conclusions  
and  
Discussions

Backup slides

	random effect models				fixed effect models			
	(1) clus. se.	(2) AR1	(3) clus. se.	(4) AR1	(5) clus. se.	(6) AR1	(7) clus. se.	(8) AR1
<b>year before turnover</b>	+	+	/	/	+	+	/	/
<b>year in office</b>	/	/	-	-	/	/	-	-
<b>year in office<sup>2</sup></b>	/	/	+	+	/	/	+	+
<b>second term</b>	+	+	+	+	+	+	+	+
Local secretary								
SOE experience								
GDP per cap								
GDP per cap <sup>2</sup>								
GDP growth								
Road density								
FDI								
Population density					-	-	-	-
Urbanization	+		+		+	+	+	
Taxi usage	-	-	-	-	-	-		-
Dist. to Beijing	-	-	-	-	/	/	/	/
Dist. to prov. cap.	-	-	-	-	/	/	/	/
Elevation	-	-	-	-	/	/	/	/
Top 10 coal sale	+	+	+	+	/	/	/	/
No. of power plants					/	/	/	/

/: not included in the model specification

# effects of year in office and second term



Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

# Conclusions and Discussions

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Key empirical finding: a U-shaped relationship between a leader's years in office and air pollution.

Also:

- year before turnover associated with higher pollution;
- second term “dirtier” than first term;

Future/ongoing efforts:

- local industrial interest groups: working on firm-level data;
- local government extractive capacity;
- control spatial spill-over effects: prevail wind directions ...



# other empirical findings

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

- no Environmental Kuznets Curve (EKC)
- FDI has no effect
- the further away from Beijing and/or from provincial capital, the better the air quality
- elevation matters
- top 10 coal sale cities almost 30% higher PM levels than other cities
- better to use more tax

# PM2.5

Motivation  
and Intuitions

Theory

Data and  
Empirical  
Analysis

Conclusions  
and  
Discussions

Backup slides

Data before spatial overlay: Global Annual PM2.5 Grids data set by the NASA: a continuous surface of concentrations in micrograms per cubic meter of particulate matter of 2.5 micrometers or smaller (PM2.5).

- PM: a relatively complex mixture with extremely small particles and liquid droplets that float around in the air (e.g., combustion particles, organic compounds, and metals);
- much smaller than inhalable coarse particles (PM10)  $\Rightarrow$  can reach the deepest regions of our lungs;
- linked to variety of significant health problems, ranging from aggravated asthma to pre-mature death in people with heart disease;
- The WHO guideline for PM2.5 average annual exposure is  $\leq 10.0$  micrograms per cubic meter, whereas the US EPA primary standard  $\leq 12.0$ .