

Brain Drain:
The Impact of Air Pollution on Firm Performance
By Xue, Zhang and Zhao

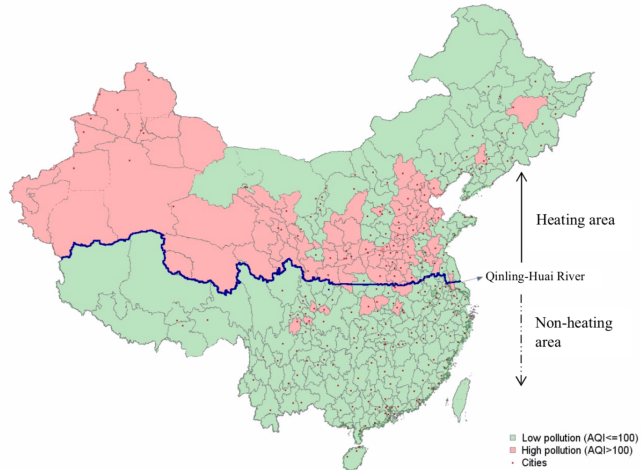
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August 21, 2020

Summary

1. Higher pollution $\Rightarrow$ more online searches for jobs in less polluted cities
 2. Increase in pollution monitoring & disclosure $\Rightarrow$ worse executives and employees
 3. Increase in pollution level $\Rightarrow$ worse executives and employees
 4. Higher pollution $\Rightarrow$ decline in TFP and firm value, with larger effect on firms relying on human capital
- ▶ “Brain Drain”: high-skilled workers and managers move away from polluted cities

A North-South Divide in Pollution



A North-South Divide in Pollution

1. Pollutants

1.1 Coal-based heating

1.2 Steel industry

1.3 Close to deserts

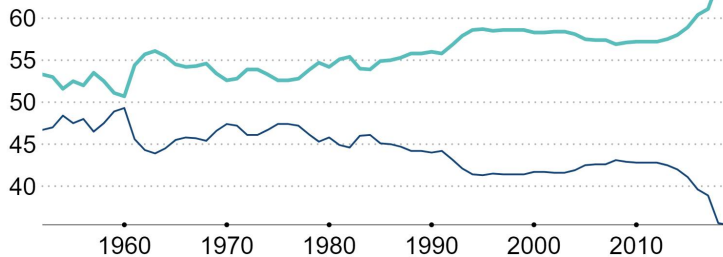
2. Climate and geography

2.1 The North is drier, flatter, and further away from the ocean $\Rightarrow$ thermal inversions

A North-South Divergence in Economy

Share of GDP in China (In percent)

■ North ■ South

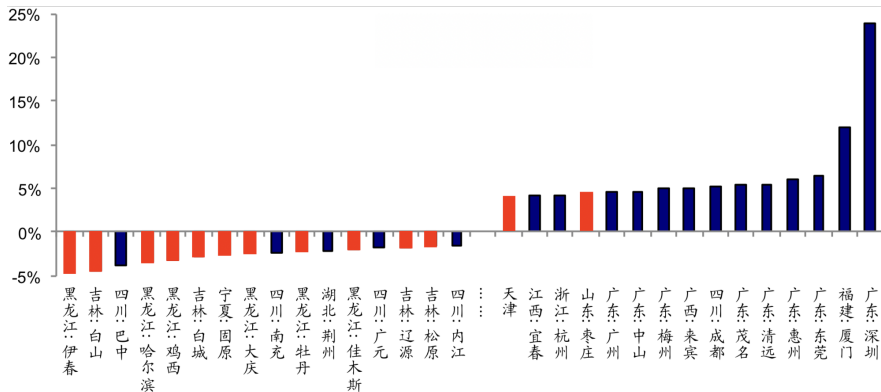


Source: CEIC

A North-South Divergence in Economy

Figure: Population growth in Chinese cities in the 2010s

Blue bars: South Red bars: North

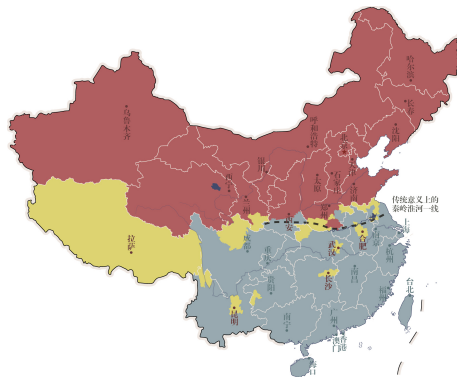


Qinling-Huai River Regression Discontinuity

- ▶ Bandwidth: 2 degrees of latitude = 222 kilometers
- ▶ Zhengzhou (4th largest city in the North by GDP) is 2.6 degrees from Nanjing (9th largest city in the South), and 3.5 degrees from Shanghai (largest city in the South)
- ▶ Many differences between these cities: industry structure, economic policy, culture

Qinling-Huai River Regression Discontinuity

- ▶ A narrower bandwidth?



- ▶ Whether there is central heating is an important amenity too

Thermal Inversion as IV

- ▶ 2SLS specification:

$$AQI_{it} = \gamma_0 + \gamma_1 TI_{it} + X_{it} + T + I + L + u_{it}$$

$$y_{it} = \theta_0 + \theta_1 \hat{AQI}_{it} + X_{it} + T + I + L + \epsilon_{it}$$

control for year fixed effects T , industry fixed effects I , longitude fixed effects L

- ▶ Variation comes from North vs South
- ▶ North-South differences in thermal inversions correlate with confounders
- ▶ Suggestion: add city fixed effects (over time variation) or province-year fixed effects (within province variation)

Interact Pollution Level with Pollution Awareness

- ▶ Central puzzle in environmental/development economics: why is marginal willingness to pay (MWTP) for environmental quality improvements so low in developing countries? (Greenstone and Jack 2015)
- ▶ One possible explanation: lack of monitoring and awareness
- ▶ A unified framework interacting (instrumented) pollution level with awareness (post monitoring program dummy):

$$y_{it} = \beta_0 + \beta_1 \hat{AQI}_{it} + \beta_2 \hat{AQI}_{it} \times Post_{it} + X_{it} + \epsilon_{it}$$

y_{it} : online job search, worker and executive quality, firm performance

Measurement

- ▶ More direct measures of executive quality: college education, experience
- ▶ % of high education employees (mean 0.26) and % of low education employees (mean 0.70)

<i>% of high education employees</i>	<i>% of low education employees</i>	<i>% of high education employees</i>	<i>% of low education employees</i>	<i>% of high education employees</i>	<i>% of low education employees</i>
-0.051*** (-2.75)	0.034 (0.93)	-0.011** (-2.06)	-0.002 (-0.15)	-0.714** (-2.55)	-0.162 (-0.36)

- ▶ TFP measure (Levinsohn-Petrin) for non-manufacturing firms? Labor productivity (value added per worker) may be better
- ▶ Profitability: higher wages (compensating differential) could be another cost
- ▶ Patents and inventors as a measure of innovative human capital

Conclusion

- ▶ Studies an important and interesting question at the intersection of environmental economics, labor economics and corporate finance
- ▶ Suggestions:
 - ▶ Sharpen the identification strategy
 - ▶ Have a unified framework to study interaction of pollution awareness and actual pollution
 - ▶ More direct measures of manager quality and firm performance