Impact of Regulations on International Air Quality Over Time

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Outline

Introduction
Regulations
  Specific & Global
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Introduction

**Objective:** Evaluate correlation between regulations restricting air emissions and air quality around the globe.

\[ \text{CO Air Quality, 1960} \]
(Annual 2nd Maximum 8-hour)
National Trend based on 69 sites.

Regulations & Trends Over Time:
U.S., India, China, EU

Global Policies

Comparing & Drawing Conclusions
Regulations - United States of America

● 1955: **Air Pollution Control Act**
  ○ First federal legislation involving air pollution

● 1963: **Clean Air Act**
  ○ First federal legislation regarding air pollution control

● 1967: **Air Quality Act**
  ○ Expand studies of air pollutant monitoring and control techniques

● 1970: **Clean Air Act**
  ○ Initiate NAAQS, SIPs, NSPS, NESHAP
  ○ EPA establish as enforcement agency

● 1977: **Clean Air Act Amendments**
  ○ Attempt to preserve stratospheric ozone

● 1990: **Clean Air Act Amendments**
  ○ Increase authority of Federal Government
Trends Over Time - United States of America

- From 1970 to 2014, national emissions of six common pollutants dropped average of 69%
- EPA phased out lead in motor vehicle gasoline under Clean Air Act authority & now meets air quality standards in most areas of the country
United States Pollution Trend

NO$_2$ in 2005

NO$_2$ in 2014

NO2 Air Quality, 1980 - 2015
(April 9th Percentile of Daily Max 1-Hour Average)
National Trend based on 26 Sites

1980 to 2015: 59% decrease in National Average
Regulations - India

● 1981: The Air (Prevention and Control of Pollution) Act
  ○ First act formulated with sole purpose to improve quality of air and provide for prevention, control and abatement of air pollution
  ○ Established Central Board and State Boards
● 1986: The Environment (Protection) Act
  ○ Gives Central Government power it deems necessary to protect and improve quality of the environment
● 2009: Revised India NAAQS
  ○ Lowered maximum permissible pollutant limits
  ○ Set standards uniform across the nation
Trends Over Time - India

- Level of PM2.5 reached 999 µg/m³ in parts of the Delhi, safe limit is 60
- The pollution benefits of industries outweigh the risks
Regulations - China

● 1982: Ambient Air Quality Standard
  ○ “Total Suspended Particles (TSP)”: SO2, NO2, Lead, and BaP (Benzo(a)pyrene)
● 1996: Standards raised from 1982 limits
● 2000: PM10, NO2 and SO2 monitored for Air Quality Indices
  ○ Monitoring of these showed improved air quality; inconsistent with resident observations
  ○ PM2.5, CO, O3 ignored until 2013
● 2012: New Ambient Air Quality Standard
  ○ Standards for PM2.5, PM10, O3, SO2, NO2 & CO
● 2013: Air Pollution Prevention and Control Action Plan
  ○ PM2.5, PM10, O3, SO2, NO2 & CO
● 2014:
  ○ 2014 revised Environmental Protection Law
  ○ Law of Prevention and Control of Air Pollution passed 1st review by Congress
Trends Over Time - China

- Announced "war on air pollution" in 2014:
  - ↓ coal consumption, # cars, ↑ renewable energy
  - Work toward 2013 Air Pollution Prevention and Control Action Plan
  - In 2014: 15 national air pollution standards issued, 15 new local standards implemented
  - Beijing's average PM2.5 concentration has decreased 40%

- 8/74 of biggest cities passed China's Ambient Air Quality Standards in 2014
  - Only 3/74 in 2013 passed: improvement
  - Rapid economic development with dependence on coal energy
  - PM pollution = largest concern
Regulations - European Union

- **1980**: EU Air Quality Management Regime Started
- **1996**: Air Quality Framework Directive
  - Limits for Lead, Nitrogen Dioxide, and Ozone
- **1999**: First Daughter Directive Act
  - Harmonize within entire EU
- **2001**: Large Combustion Plant Directive
  - NEC Directive → Report to EEA
- **2003**: Recommendation on the Guidelines to Assist Member States
  - National Emission Reduction Plan
- **2008**: Air Quality Directive
  - Stationary and Mobile Source Controls
Trends Over Time - European Union

- EU established in 1993
- EU-15 established National emissions ceilings in 2001
- No EU-level review for determining management zones
- Plans are required only if zone is in exceedance → Sanction
- No mechanisms to ensure that Member States work together
- Peer Pressure and Persuasion → “Name and Shame”
- Need more centralized regulatory actions

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>1980</th>
<th>2001</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>3433</td>
<td>827</td>
<td>-75.9%</td>
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<tr>
<td>SO2</td>
<td>6745</td>
<td>494</td>
<td>-92.7%</td>
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<tr>
<td>VOC</td>
<td>4210</td>
<td>823</td>
<td>-80.5%</td>
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</tbody>
</table>
Regulations - Global

- 1972: Stockholm Declaration
  - UN Conference on Human Environment
- 1997: Kyoto Protocol
  - UN Framework Convention on Climate Change
- 2016: Paris Agreement
  - UN Framework Convention on Climate Change
Global Comparison

- All exceed World Health Organization limits
  - Many also exceed their own regulations
- Each country or region has different enforcement methods
- India is the only place we considered where emissions are rising
  - Developing countries poorly manage pollutants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>World Health Org</th>
<th>European Union</th>
<th>Australia</th>
<th>United States</th>
<th>Canada</th>
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</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>50</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td>65</td>
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<tr>
<td>8 hour, parts per billion</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fine particulate</td>
<td>25</td>
<td>50</td>
<td>25</td>
<td>65</td>
<td>30</td>
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<tr>
<td>24 hour, micrograms per cubic meter</td>
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<td></td>
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<tr>
<td>Sulphur dioxide</td>
<td>8</td>
<td>48</td>
<td>80</td>
<td>140</td>
<td>115</td>
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<tr>
<td>24 hour, ppb</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nitrogen dioxide</td>
<td>21</td>
<td>21</td>
<td>30</td>
<td>53</td>
<td>53</td>
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<tr>
<td>Annual, ppb</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Carbon monoxide</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>13</td>
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<tr>
<td>8 hour, ppm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lead</td>
<td>–</td>
<td>0.5</td>
<td>0.5</td>
<td>1.5</td>
<td>–</td>
</tr>
<tr>
<td>Micrograms per cubic meter</td>
<td></td>
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Note: A dash (–) indicates that no standard or guideline has been established for a particular parameter.
Relevance

- Health and Environmental Impacts
- Economic, Social and Political Context
In most countries air pollution emissions are decreasing in response to regulation.

The only country with results diverging from this conclusion is a developing country that does not work to enforce regulation effectively.

The overall decrease is not sufficient according to WHO standards.
Resources

https://www.youtube.com/watch?v=Ybh11kcDhfM
http://www.cbsnews.com/pictures/smoggy-fog-envelops-china/7/
http://www.who.int/phe/health_topics/outdoorair/outdoorair_agg/en/
http://www.who.int/phe/health_topics/outdoorair/outdoorair_agg/en/
http://english.sepa.gov.cn/Resources/standards/Air_Environment/
http://transportpolicy.net/index.php?title=China_Air_Quality_Standards
http://www.eea.europa.eu/themes/air/intro
http://urbanemissions.blogspot.com/2013/08/debunking-indias-transport-diesel.html
http://epi.yale.edu/sites/default/files/Yale%20EPI%20Metadata_2016_0.pdf
http://www.environmentallawsofindia.com/the-air-act.html
http://www.arthapedia.in/index.php?title=Ambient_Air_Quality_Standards_in_India
https://www.epa.gov/clean-air-act-overview/evolution-clean-air-act
https://www.ametsoc.org/sloan/cleanair/cleanairlegisl.html
https://www.researchgate.net/publication/280221920_Air_Pollution_and_Control_Legislation_in_India
Thank You!
Questions?