

Methods of Assessing Air Pollution and Economic Development in Colombia

UC SANTA BARBARA
Geography

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INTRODUCTION



Inverted-U Shape
(Environmental Kuznets Curve) [2]

- London showed an inverted-U shape relationship between air pollution and economic development [3].

QUESTIONS

- Can the same inverted-U shape be observed in developing countries as in London?
- In the United States, air pollution disproportionately affects disadvantaged populations. Do we see the same environmental justice issues in Colombia?

OVERVIEW

- Colombia is a middle-income country with a growing economy. Compared to the rest of the world, Colombia suffers from high levels of air pollution.
- In 2018, the global median PM 2.5 value was 12.8, while the median PM 2.5 value in Colombia was 18. Exposure to air pollutants like PM 2.5 can cause respiratory diseases and have serious health consequences [4].
- Poor air quality can also impact economic activity by reducing worker productivity, increasing healthcare costs, and reducing tourism [5].
- In 2018, Colombia's GDP was \$334.2 billion, making it the fourth-largest economy in South America [6].

DATA

- Annual Mean Surface PM2.5 [$\mu\text{g}/\text{m}^3$] at $0.01^\circ \times 0.01^\circ$ [7]
- Colombia 2018 Census [8]
- Colombia Departmental GDP [9]
- USGS GTOPO30 Elevation [10]

METHODS

- We conducted a spatial correlation analysis to investigate the relationship between changes in air pollution and GDP over time.
- Air pollution has strong spatial autocorrelation (local Moran's I = 0.74).

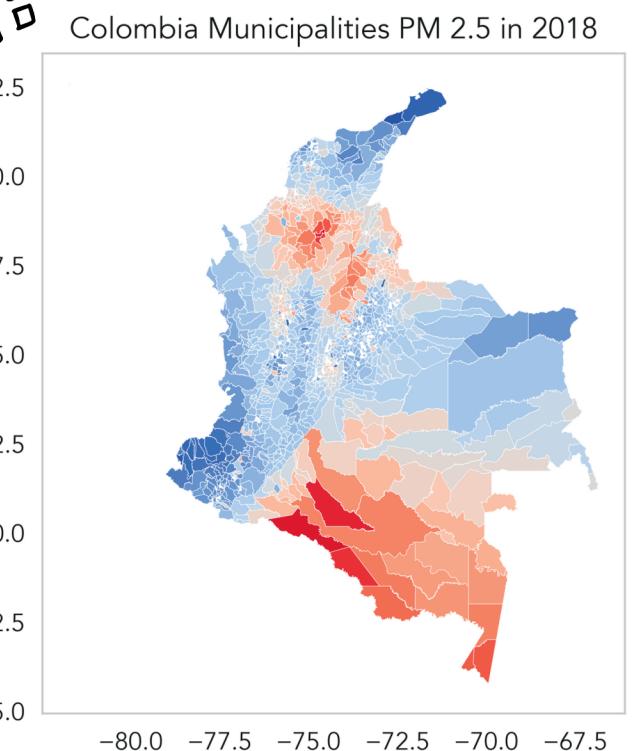


TRENDS

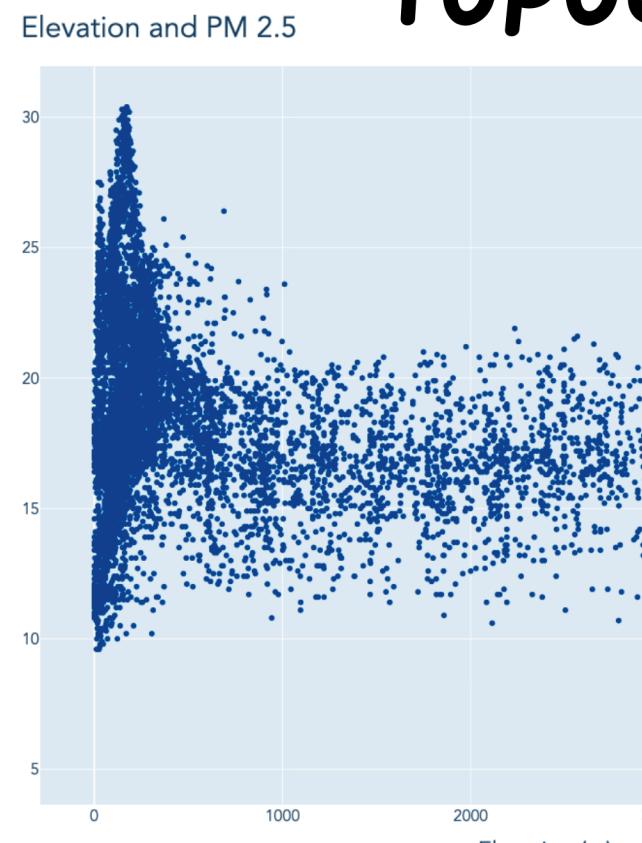
- Some Departments showed an inverted-U shape trend



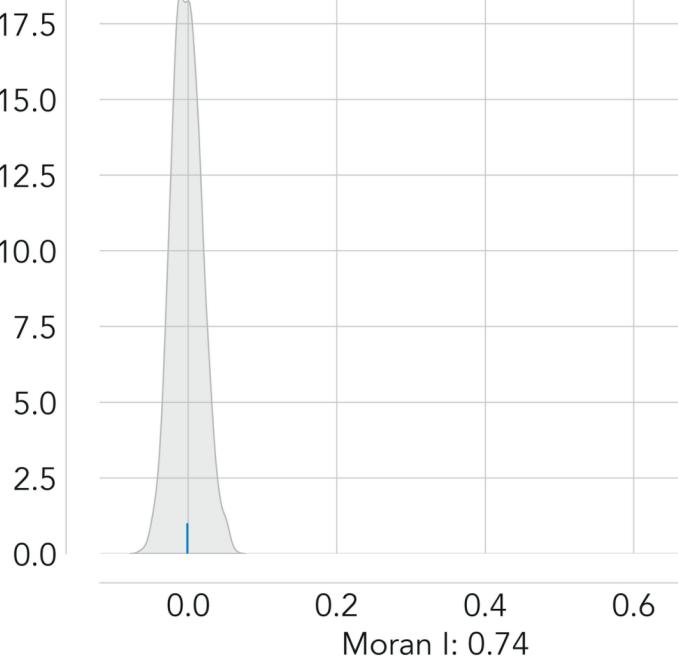
Colombia Municipalities PM 2.5 in 2018



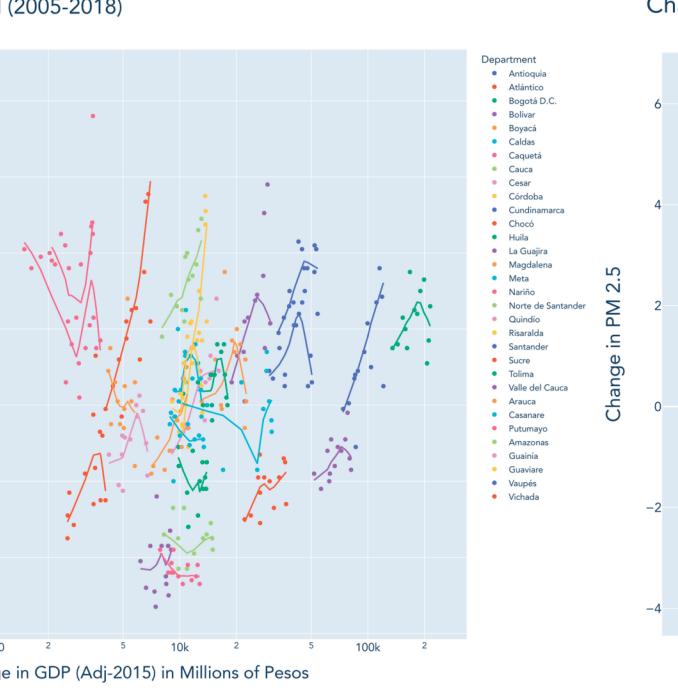
Elevation and PM 2.5



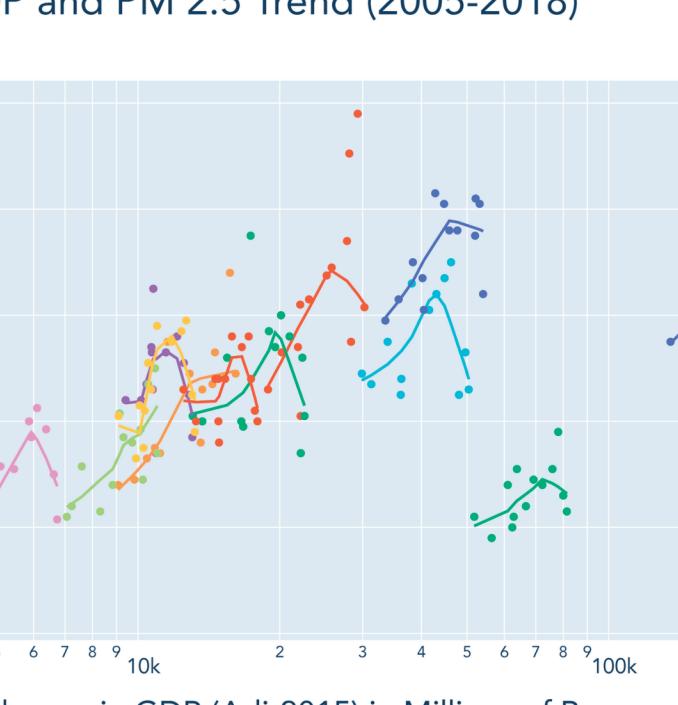
Reference Distribution



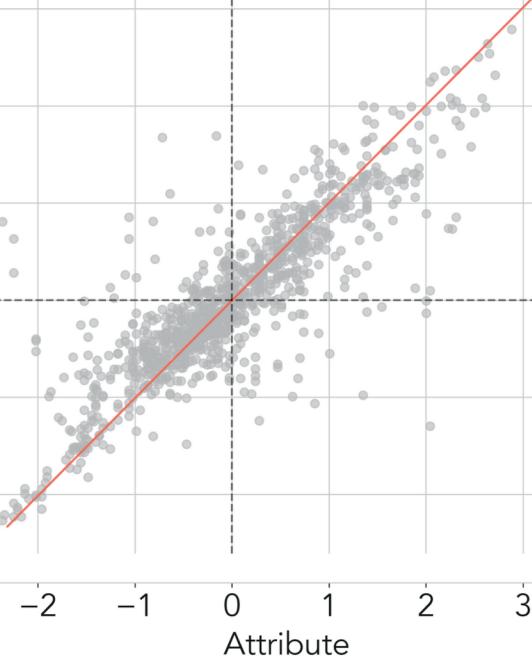
GDP and PM 2.5 Trend (2005-2018)



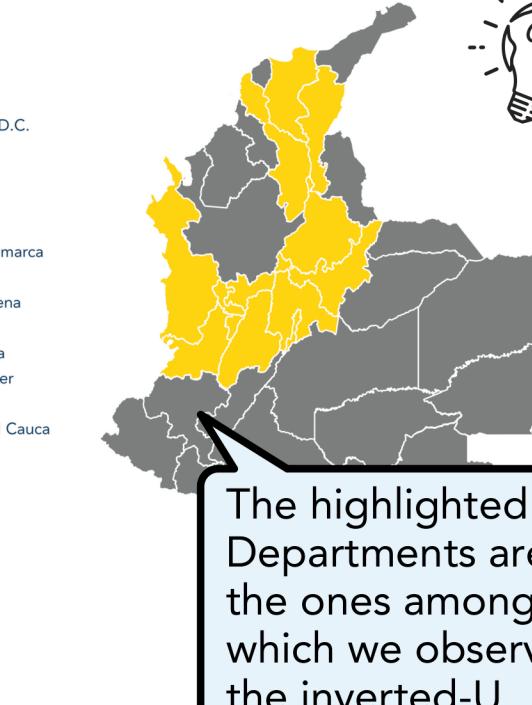
Inverse-U GDP and PM 2.5 Trend (2005-2018)



Moran Scatterplot (0.74)



Change in GDP Per Capita and PM 2.5 (2005-2018)



DISCUSSIONS

- We observed preliminary evidence for an inverted-U shape relationship between economic growth and air pollution.
- Air pollution is not significantly higher in disadvantaged communities.
- Clustering analysis and Global Moran's I suggest that air pollution is spatially correlated with certain geographic features [12].

NEXT STEPS

- Connect more census data with air pollution observations.
- Expand the study to other developing and underdeveloped countries that get less attention.
- Introduce population density and weigh air pollution more in a densely populated area.
- GDP per capita is not a bad measure of poverty, but a direct measure is more preferable.

LIMITATION

- Air pollution data is derived from remote sensing data, which can be inaccurate.

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