



Research Questions

1. Does the introduction of light rails affect the particulate matter (PM2.5) levels in Charlotte, North Carolina?
2. Do different income brackets have different levels of reduction after introducing light rails?

Background

1. Location: Charlotte, North Carolina
2. Stations: 26 Blue Lynx Light Rail Stations
3. Time Frame: November 2003 - November 2011
4. Other pollution sources: Airports, Power plants, Intersections

Results I

DB-OLS Regression Table

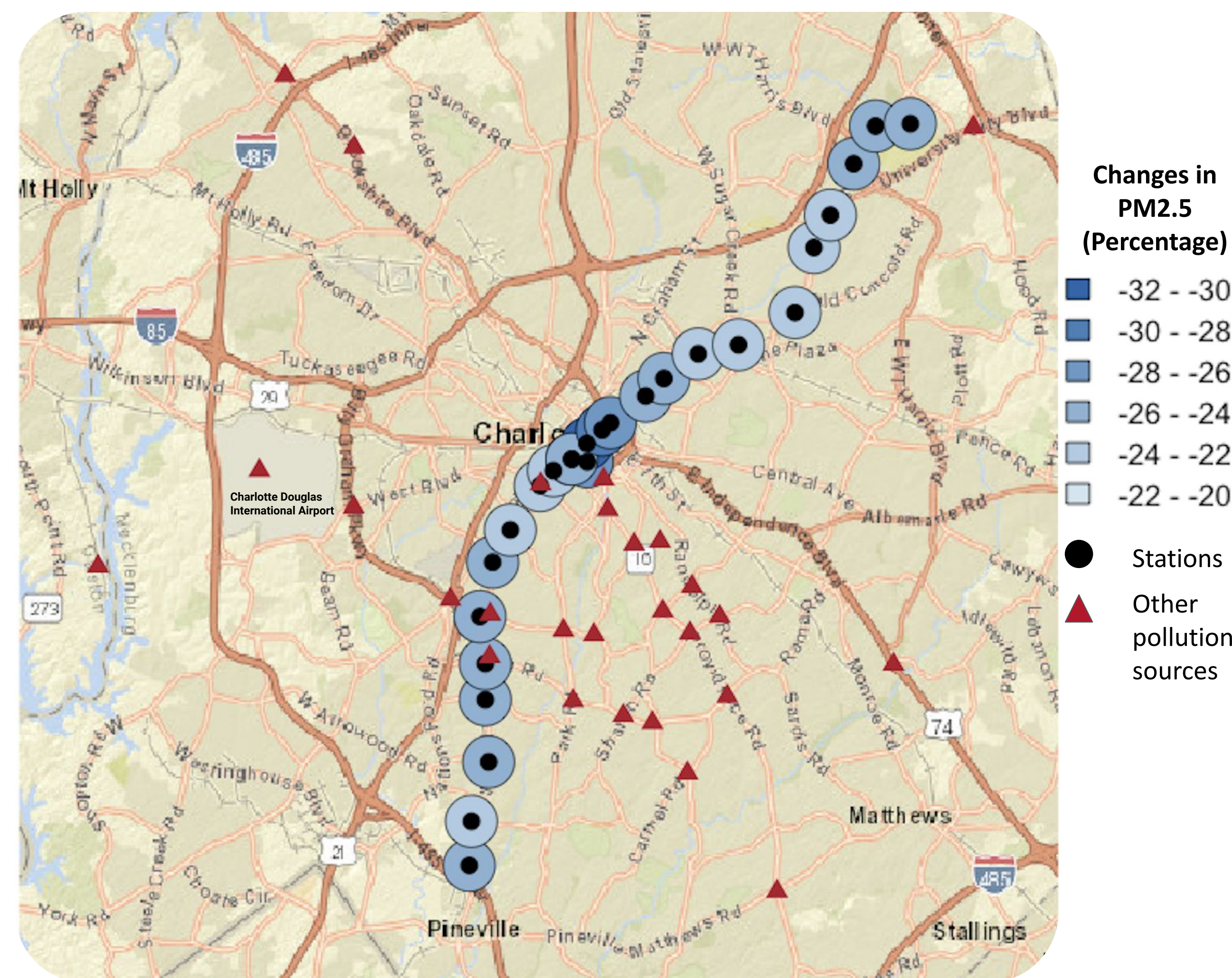
Log(PM2.5)					
Factors	(1)	(2)	(3)	(4)	(5)
MetroOpen	-0.26***	-0.31***	-0.30***	-0.30***	-0.26***
Construction Dummy		X	X	X	X
Day of Week Fixed Effects		X	X	X	X
Month Fixed Effects		X	X	X	X
Temperature, Wind, Humidity			X	X	X
Holiday Binary				X	X
All Other Weather Controls					X
Clean Air Interstate Rule Binary					X

*** means the result is statistically significant with p-values ranging from 0 and 0.001

- Our regression used the Discontinuity-Based Ordinary Least Square model which assumes a large effect starting from light rail opening day while other control variables remain continuous.
- The regression analysis in column (1) suggests a significant reduction of approximately 23% ($=100 \times (e^{-0.26} - 1)$) in PM2.5 levels because of the metro opening. Average results from column (2) to (5) suggests average of 26.5% reductions of metro operations in reducing PM2.5 concentrations.

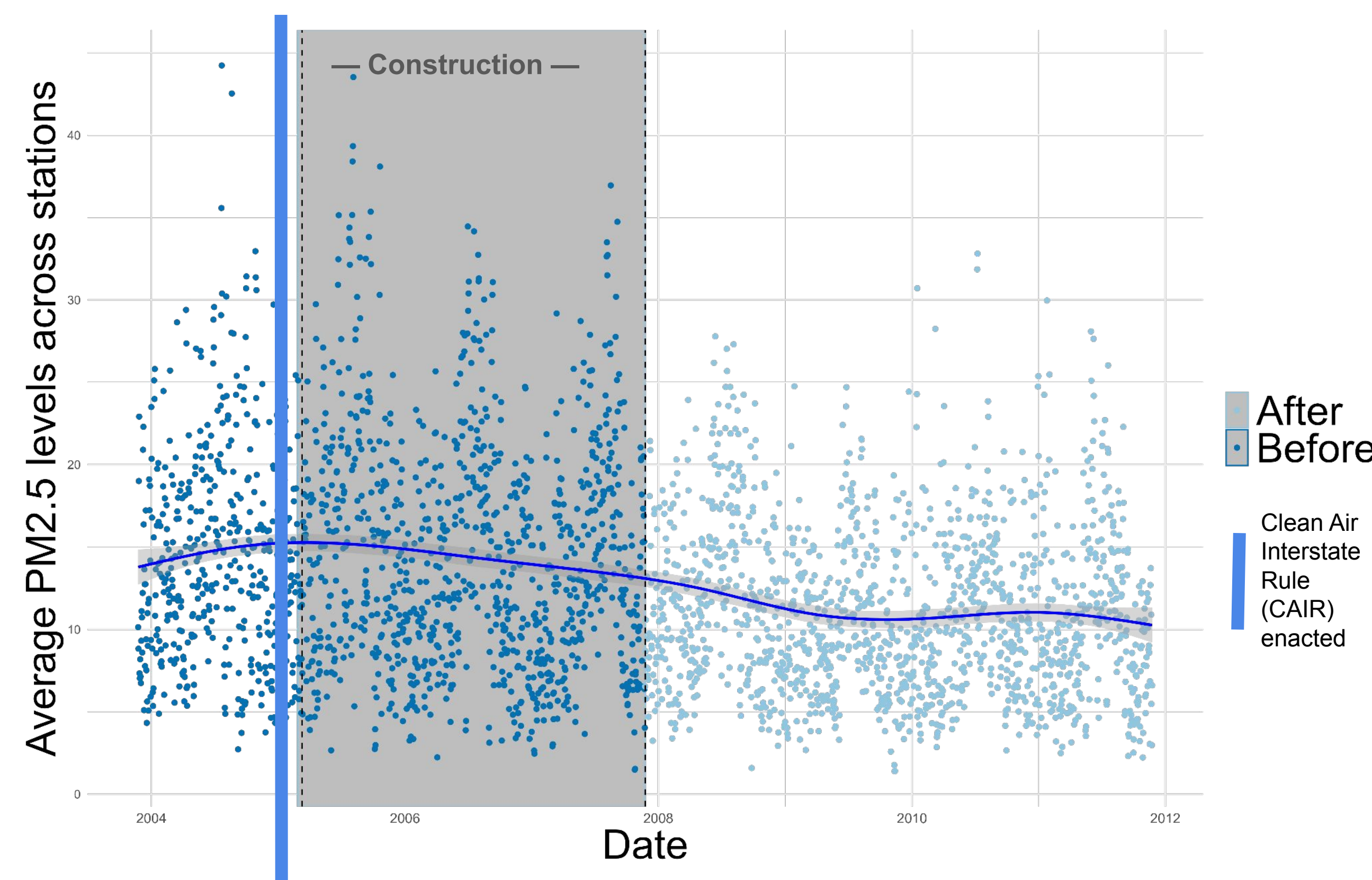
Results II

Reduction Benefit in PM2.5 with Factors



The map highlights the reduction benefit of PM2.5 levels around the Blue Lynx Light Rail stations in Charlotte. A significant reduction, about 30%, is observed between station 13 and 15, which is likely influenced by a nearby conference center, suggesting increased use of the light rail system for travel.

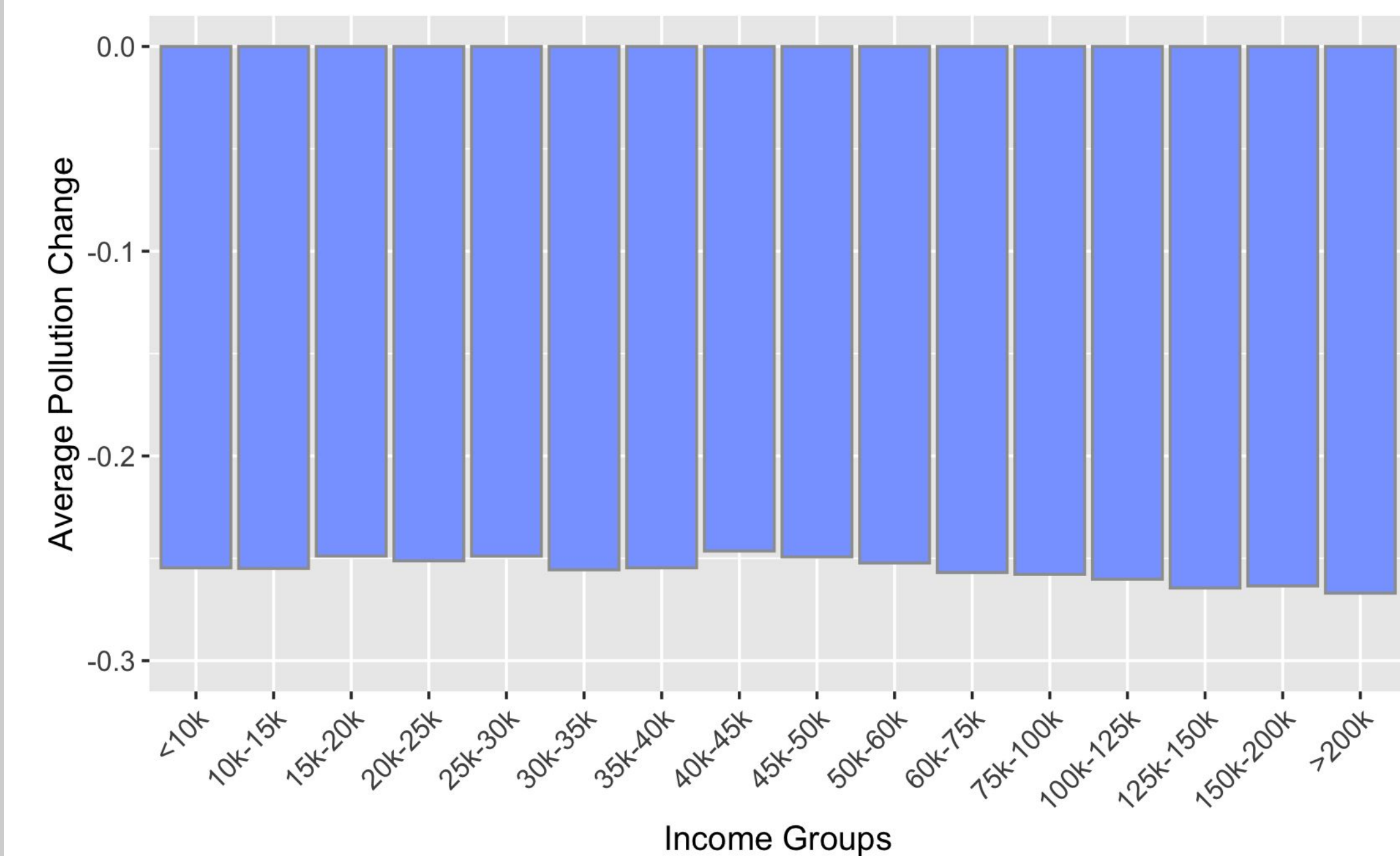
PM2.5 Trends Over Time



The scatter plot illustrates a decline in PM2.5 levels over time, notably following the introduction of light rails in 2007. Higher PM2.5 levels are also evident during the construction phase from 2005 - 2007.

Results III

Effect of PM2.5 across Income Groups



- We hypothesize that lower-income individuals live closer to metro rail lines and high-density urban areas, leading to higher PM2.5 exposure. Conversely, higher-income individuals likely reside in suburban areas, using private transportation and experiencing lower PM2.5 exposure.
- The bar chart reveals that all income groups experience an average reduction of approximately 25 percent, with minimal change between the groups.

Conclusions

1. **Effect of Light Rails on PM2.5 Levels:** The introduction of light rails in Charlotte is associated with a 26.5% reduction in PM2.5 levels. This confirms that the light rail system has a significant positive impact on air quality.
2. **Effect Across Income Groups:** The reduction in PM2.5 levels benefits all income groups nearly equally, with minimal variation, indicating that the improvements in air quality are broadly distributed across different income brackets.

Further Areas of Exploration

1. Has the introduction of the light rail improved the quality of human health?
2. Does including other pollution control policies, like the Diesel Emission Reduction Act, affect our estimates?