Impact of a Garbage Incinerator on House Prices and Optimal Placement. Jude Gbenimako, 20240700

Introduction

This project investigates the impact of proximity to waste incinerators on nearby property values using a Difference-in-Differences (DiD) model. It focuses on real house prices (adjusted for inflation) and aims to estimate the optimal distance to minimize negative impacts.

The dataset [1], is based on housing transactions (1978 Pre-treatment and 1981 post-treatment) and the construction of a garbage incinerator in North Andover, Massachusetts. Key covariates such as log age of houses (lage), neighborhood-level (nbh), number of rooms, log(area), number of bathrooms, and log(distance) from the incinerator. Outliers were addressed using Cook's distance and logarithmic transformations. Key questions include: Does proximity to the incinerator significantly affect house prices?, What other factors influence housing prices? and What is the optimal distance to minimize the incinerator's impact?

The project draws on insights from prior studies and validation techniques such as placebo test, for parallel trend assumption in two-period cross-sectional data [2].

Research Question

How does proximity to a garbage incinerator affect housing prices in the neighborhood?

Methods

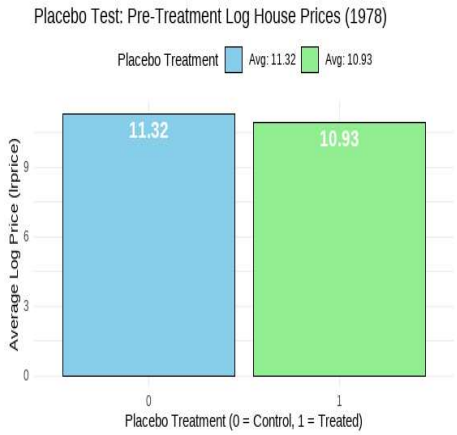
Using *R fixest package*, I compared several regression models for performance, a DiD model with clustered standard errors by neighborhoods was constructed to evaluate the causal impact of an incinerator on house prices. The selected model is: ***chosen_model <- feols(lrprice ~ i(y81) + i(nearinc) + y81:nearinc + lage + rooms + larea + baths + lland | nbh, cluster = ~ nbh)***. An extended model incorporates an interaction term for distance: ***interaction_model <- feols(lrprice ~ i(y81) + i(nearinc) + y81:nearinc + y81:nearinc:ldist + lage + rooms + larea + baths + lland | nbh, cluster = ~ nbh)***. The extended model estimates the Optimal Distance (ldist) which is the Turning Point or Safe Distance where the incinerator's impact becomes negligible. Models accounts for unobserved heterogeneity [3] (nbh Fixed Effects).

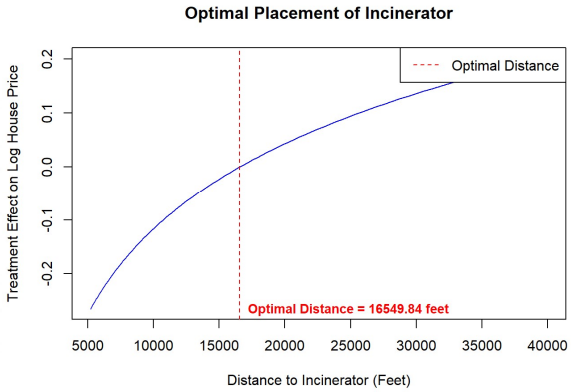
Results

The chosen model estimates that proximity to the incinerator significantly reduces house prices by 11.13% post-construction (*y81:nearinc*). Significant covariates include lage (-0.072%) showing older houses have lower prices; rooms (+2.55%), larea (+0.35%), baths (+9.70%), and lland (+0.074%), all positively contributing to house prices. The extended model refined by incorporating distance to the interaction (*y81:nearinc:ldist*) , show a large initial negative impact of (*y81:nearinc*) (-222.88%) mitigated by a 22.94% positive adjustment per log unit of distance. The optimal distance is 16,549.84 feet, beyond which the negative effect of the incinerator diminishes significantly. The FE estimates for the nbh range from 7.40 nbh:3 to 7.57 nbh:0, which is about 18.4% higher house prices on average in nbh:0.

Model assumptions tests (α = 0.05)

Test	P-value	H_o	Conclusion
RESET	0.07953	No misspecification	No evidence of misspecification
Shapiro-Wilk	0.4353	Residual normality	Residuals are normally distributed
Placebo	0.9888	No pre-treatment difference	Treated and control groups had similar trend





Conclusion

Proximity to the incinerator significantly reduces house prices by **11.13%** post-construction, as stated by the *y81:nearinc* term result. FE and other key covariates also significantly influence house prices. Including *y81:nearinc:ldist* identified an optimal distance of **16,549.84** feet to minimize the incinerator's negative impact, providing actionable insights for urban planning.

Future Work

Future research should use multi-period data to strengthen robustness and validate assumptions over time. Exploring confounding factors, such as local economic conditions, environmental regulations and public perception of incinerators, can refine the model. Further Analysis on neighborhood-specific factors. Testing across other regions with incinerators will improve generalizability.

References

[1] **Wooldridge, J.M.** (2024). *Introductory Econometrics: A Modern Approach, 7e. Available at:* https://rb.gy/ynh6ne

[2] **Cunningham, S.** (2021). *Causal Inference: The Mixtape*. Chapter 9: Difference in Differences. *Available at:* https://rb.gy/ynh6ne

[3] **Bergé, L. (2023).** fixest: Fast Fixed-Effects Estimation. https://rb.gy/w0vjhw