

Traffic, Transit, and the Toll

Causal Evidence from NYC's Congestion Pricing Policy

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Motivation

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On January 5, 2025, New York City launched the first congestion pricing zone in the United States. Vehicles now pay \$9 – \$23 to enter Manhattan south of 60th Street.¹

The program has three stated goals:

1. Reduce vehicle traffic and gridlock
2. Improve air quality and street safety
3. Generate revenue to fund MTA capital improvements

Policy Overview

Effective	Jan. 5, 2025
Boundary	60th / 61st St
Car toll	\$9 – \$23
Truck toll	\$14 – \$22

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Descriptive reports suggest the program has already reduced vehicle entries by 11%, raised \$550M in net revenue, and improved transit ridership across all modes.²

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Descriptive evidence so far

- Traffic down 11%, 27M fewer vehicles
- PM_{2.5} pollution down 22% in the zone
- Crashes down 7%, injuries down 8%
- Sales tax receipts up 6.3%
- Transit ridership up 7% system-wide

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- None of the above is causal
- Existing causal work examines different outcomes, effects on buses, taxis, and related analyses of the 2021 CBD cordon proposal, not the traffic, transit, and economic spillover outcomes studied here
- Confounders: macroeconomic trends, post-pandemic recovery, seasonal effects

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This paper aims to provide causal estimates using the sharp geographic boundary at 60th Street.

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C2Smart: Traffic Cameras

305 sensors · 15-minute intervals

Passenger vehicles, trucks, pedestrians, bikes

Jan – Mar 2024 (pre) and Jan – Mar 2025 (post)

Sensor coordinates linked to the 60th Street boundary via three distance measures: Euclidean, Manhattan grid, and OSMnx network distance (primary specification).

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123 stations, hourly fare-tap records

Full sample with fare-type heterogeneity

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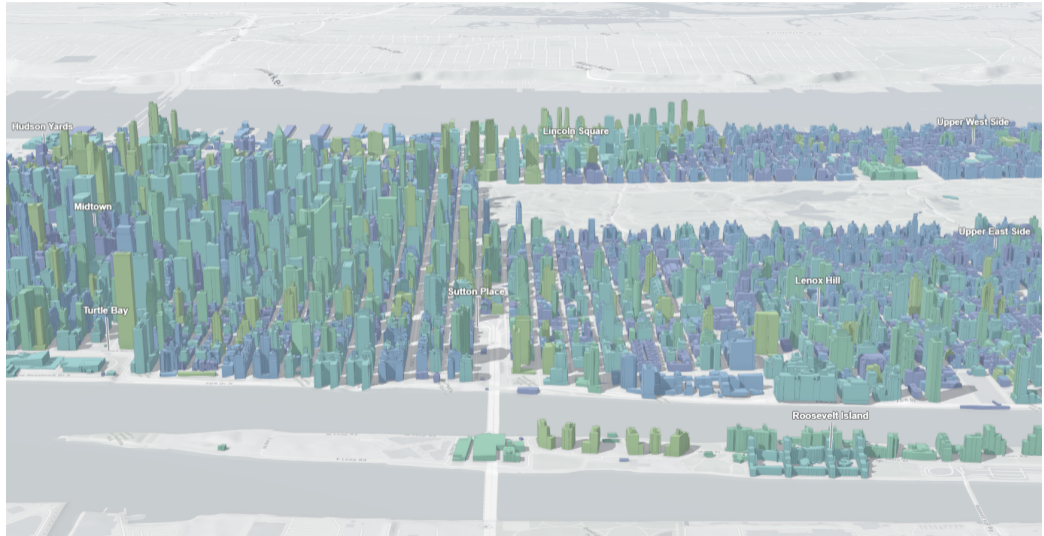
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Regression Discontinuity Design

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So we use **Difference-in-Discontinuities (DD-RD)**

Treatment effects are identified by differencing the post-period spatial discontinuity from the pre-existing one:

$$\hat{\tau} = \hat{\alpha}_{\text{post}} - \hat{\alpha}_{\text{pre}}$$

This removes any pre-existing sorting at the boundary.

Interpreting the Estimate

- $\hat{\alpha}_{\text{pre}}$: baseline jump at 60th St
- $\hat{\alpha}_{\text{post}}$: jump after congestion pricing
- $\hat{\tau}$: change in the discontinuity

Key Idea:

How much did outcomes change at the boundary after the policy, relative to before?

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We also estimate an event study to assess pre-trend behaviour, though results today focus on the DD-RD estimates.

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DD-RD estimates, global linear, network distance

	DD-RD	Effect (%)	
Passenger vehicles	-0.73	-19.2%	***
Trucks	-0.069	-15.9%	***
Pedestrians	+0.45	+14.7%	***
Bikes	+0.0013	+23.2%	***

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Vehicle and truck counts fall at the boundary.

Pedestrian and bike counts increase near the boundary, consistent with mode substitution and increased street-level activity as vehicles clear out.

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Fare-type heterogeneity (DD-RD)

Fare group	DD-RD	
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Full fare	-35.94	***
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Unlimited passes	-11.13	**
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Ridership falls close to the zone boundary, rather than rising. The expected modal shift from cars to transit did not materialise at zone stations.

Full-fare and unlimited-pass riders show the largest reductions. Subsidised riders (students and seniors) show no significant effect.

Results are robust to alternative model specifications and all three distance measures.

Results: Economic Spillovers

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DD-RD estimates, IHS log outcome, network distance

Dataset	DD-RD	Effect (%)	
Business licenses	+0.011	+116.0%	***
311 complaints	-0.024	-2.7%	
Construction permits	-0.004	-7.2%	*
Evictions	+0.001	+1.6%	

Location \times week panel, 2024–2025.

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Location \times week panel, 2024–2025.

Business licensing increases near the boundary, consistent with greater foot traffic and commercial activity as vehicle congestion falls.

Construction permitting declines, consistent with reduced vehicle access disrupting building activity close to the zone, and hesitancy for long term investment.

These are novel findings. No prior congestion pricing study has examined this set of outcomes with a causal design.

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- 2. Transit.** Metro ridership falls inside the zone. Full-fare riders are most affected. The modal shift hypothesis is not supported.
- 3. Economic activity.** Business licensing increases near the boundary. Construction permits decline. Suggestive of spatial reorganisation around the cordon and anticipatory effects.

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Limitations

- Traffic Cam Data: Short post-period (9 weeks)
- Substantial structural differences between treated and control areas
- Sensor coverage is not geographically uniform across Manhattan
- Missing interval-level timestamps on sensor data: unclear which 15-minute window each observation belongs to

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Next steps

- Reconstruct complete sensor timestamps from NYC public camera data
- Controls for geospatial neighbourhood characteristics

Thank You

Questions welcome

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Appendix

Appendix: Estimating Equation

Global linear DD-RD specification:

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta_2 D_i + \beta_3 \text{Post}_t + \gamma_1 (X_{it} \cdot D_i) + \gamma_2 (X_{it} \cdot \text{Post}_t) \\ + \delta (D_i \cdot \text{Post}_t \cdot X_{it}) + \tau \underbrace{(D_i \cdot \text{Post}_t)}_{\text{DD-RD coefficient}} + \theta_t + \varepsilon_{it}$$

- X_{it} : network distance to 60th Street boundary (negative = inside CZ, positive = outside)
- $D_i = 1$: unit inside the congestion zone
- $\text{Post}_t = 1$: observation in 2025
- θ_t : week, day-of-week, month fixed effects
- τ : treatment effect of interest
- Standard errors clustered on sensor / station ID
- Period fixed effects: week, day-of-week, month
- All three distance measures estimated

Specification checks

- Bandwidths from ± 1 to ± 8 km
- Global linear and polynomial RD
- Donut RD excluding ± 0.5 km
- Non-parametric RD estimates
- Euclidean, Manhattan, and network distance measures

Placebo tests

- DD-RD repeated at 45th Street (south) and 75th Street (north)
- South placebo (45th St): units are inside the CZ and have already crossed the toll boundary. We would expect vehicles to continue south, and pedestrians/bikes to move north.
- North placebo (75th St): a placebo boundary used to test for anticipation effects. We expect no true policy discontinuity here, though nearby units may adjust behavior in anticipation of congestion pricing.

Core traffic and Metro results hold across all specifications.

Appendix: Bandwidth Sensitivity (C2Smart)

DD-RD coefficient with 95% confidence intervals at bandwidths from ± 1 to ± 8 km. Network distance. Sign and significance are consistent across all windows.

Appendix: Fare Heterogeneity (Metro DD-RD)

Fare Type	Post RD	Pre RD	DD-RD	
Full Fare	21.20	58.89 ^{**}	-35.94	^{***}
Unlimited 30-Day	27.29 ^{**}	39.23 ^{**}	-11.13	^{**}
Unlimited 7-Day	36.74 ^{***}	63.08 ^{***}	-25.68	^{***}
Fair Fare	8.89 ^{**}	13.60 ^{**}	-4.19	[*]
Students	7.08	6.40	+0.91	
Seniors & Disability	10.59	7.85	+2.52	
Other	13.57 ^{**}	19.20 ^{**}	-5.25	^{**}

Global linear DD-RD, Manhattan distance. Metrocard and OMNY combined within each fare type.

Full-fare and unlimited-pass riders drive the ridership decline. Subsidised fare categories show no significant reduction.

Appendix: Secondary Outcome Details

Panel structure

- Unit: unique rounded lat/lon ($\approx 100\text{m}$ grid)
- Time: week, 2024–2025
- Balanced panel with explicit zeros
- Two-way fixed effects: location and week

311 complaint filter

12 transport-relevant complaint types retained: Noise (Street/Vehicle/Commercial), Blocked Driveway, Illegal Parking, Traffic Signal, Air Quality, Street Condition, Derelict Vehicle, Taxi Complaint. Residential noise and unrelated complaint types are excluded.

Appendix: Metro Hour \times Treatment Interaction

Estimated ridership effect by hour of day, weekday and weekend separately. Captures heterogeneity in the treatment effect across the daily travel cycle.

Global quadratic DD-RD

Quadratic in the running variable X_{it} and all interactions. Provides a more flexible fit of the conditional mean on either side of the boundary.

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Trucks	-0.069	-15.9%	***
Pedestrians	+0.45	+14.7%	***
Bikes	+0.0013	+23.2%	***

Direction and significance are consistent with the global linear specification. Magnitude differences reflect the more flexible functional form.

Appendix: Natural Log Model (C2Smart)

Log-outcome DD-RD

Outcome transformed using a natural log (with IHS to handle zeros). Coefficients are interpretable as approximate percentage changes.

DD-RD

Passenger vehicles	-0.18	***
Trucks	-0.046	***
Pedestrians	+0.099	***
Bikes	+0.0011	***

Results are qualitatively consistent with the level specification. The log transformation confirms proportional reductions in vehicle and truck traffic near the boundary.

Appendix: Non-Parametric RD (C2Smart)

Non-parametric DD-RD

Local polynomial RD using data-driven bandwidth selection. No functional form assumption on $f(X_{it})$. Bandwidth selected via mean squared error criterion.

	DD-RD	Effect (%)	
Passenger vehicles	-0.21	-5.6%	***
Trucks	+0.003	+0.7%	
Pedestrians	+0.023	+7.4%	***
Bikes	+0.0025	+46.3%	***

Consistent with parametric specifications. The non-parametric approach confirms the result does not depend on a particular choice of functional form for the running variable.