

The Impact of Transit System on Local Crime: Evidence from Chicago's Transit System

Tzu-Hao Yan Lawrence Tseng Jingyang Wang Wenjie Tu

ETH & UZH

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Introduction

- ▶ The occurrence of crime has been proven to have a strong connection to geographical features
- ▶ Among various features, the relationship between public transit and crime is not well investigated
- ▶ Higher passenger flow may not only enhance economic development, but also increase crime rate



Figure: Crime Distribution in Chicago Metro Area

Literature Review

- ▶ Public concern over safety → one of the most important reasons why many choose not to use transit.
- ▶ Ecological approaches of analysing cause of crime: micro-environment of crime
- ▶ The relationship between transit system and crime is still in debate



(a) Underpass platform at Lakewood station



(b) Overpass platform at Central Street in Chicago

Methodology

Data Source

▶ Crime records

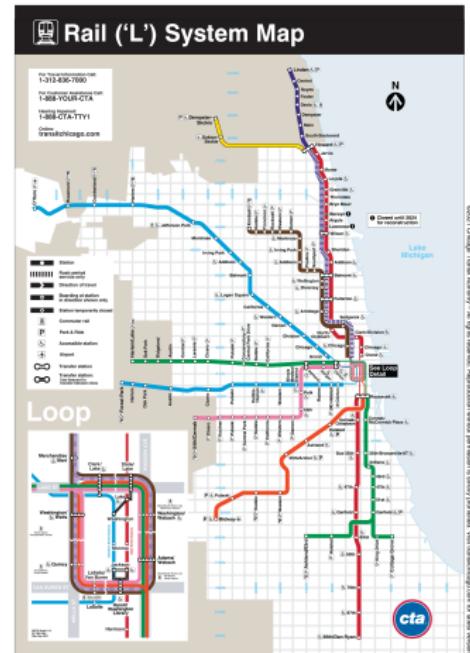
- ▶ Reported crime to CPD
- ▶ When, what, and where
- ▶ Data from 2010 to 2019

▶ Public transit information

- ▶ Chicago 'L' and CTA bus
- ▶ Route/line, station/stop, average ridership

▶ Chicago community area

- ▶ Defined in 1920s
- ▶ Better than census tracts and wards
- ▶ Relatively homogeneous in one community



Methodology

Spatial Data Processing



(c) Study Area



(d) Stations and Samples

Socioeconomic scores for the selected communities

Name	Density	Income Per Capita	Education Level	Overall Score
Lake View	8	4	4	5
Lincoln Park	2	2	2	2
Near North Side	1	1	1	1

Methodology

Spatial Data Processing



Figure: 200-Meter Buffers

Methodology

Spatial Data Processing

Table: An Overview of the Treatment Units

	station_id	station_name	community	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	1210	Wellington	LAKE VIEW	108	128	120	111	95	90	85	93	97	72
2	1450	Chicago	NEAR NORTH SIDE	608	887	833	625	450	364	439	517	594	597
3	800	Sedgwick	NEAR NORTH SIDE	168	188	130	131	162	139	131	127	226	157
4	660	Armitage	LINCOLN PARK	126	134	102	121	80	78	81	102	121	94
5	1420	Addison	LAKE VIEW	263	229	313	236	194	213	255	191	241	179
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Table: An Overview of the Control Units

	sampling_id	coordinate_x	coordinate_y	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	1	1164471.23	1924086.20	75	64	41	50	46	43	43	43	40	41
2	2	1164471.23	1921461.53	88	96	87	72	51	39	63	102	100	93
3	3	1164471.23	1920149.20	59	47	45	33	32	34	30	25	35	19
4	4	1166449.96	1924086.20	98	83	79	76	80	75	87	94	64	78
5	5	1166449.96	1921461.53	106	103	86	87	80	57	72	70	65	50
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Methodology

Theoretical Framework

$$\log Y_{it} = \beta + \delta D_{it} + \epsilon_{it}$$

- ▶ Y_{it} : the number of crime cases at area i during year t .
- ▶ D_{it} : treatment indicator, which is equal to 1 if there is a transit within area i in year t , and 0 otherwise.
- ▶ δ : the average treatment effect averaged over all years.
- ▶ ϵ_{it} : the error term.

Methodology

Assumption Check

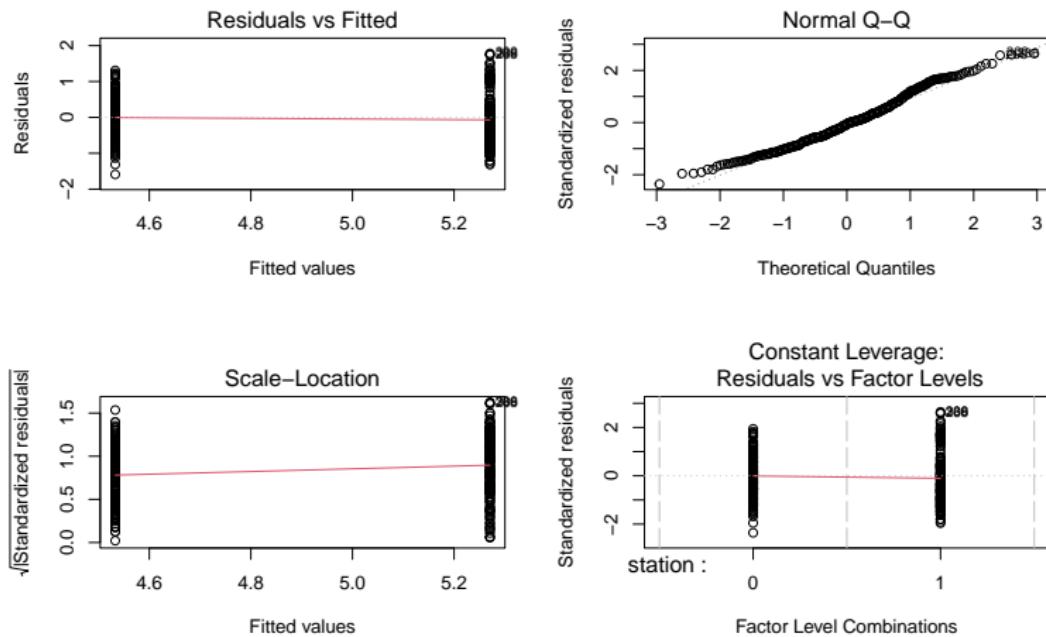


Figure: Diagnostic Plots

Results

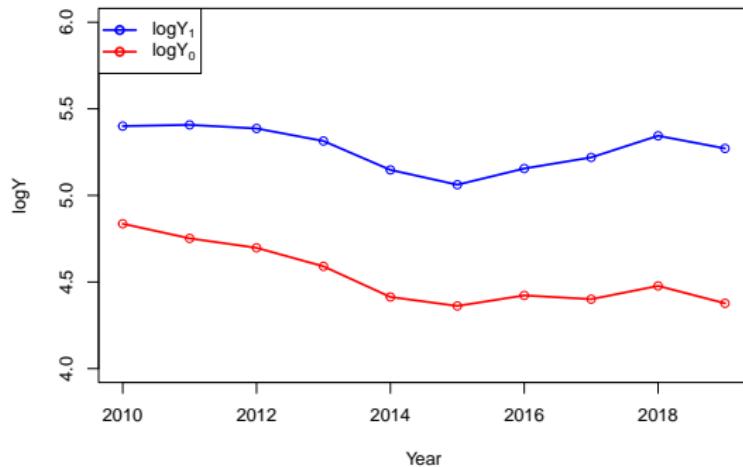


Figure: $\log(\text{Crime})$ vs. Year

Results

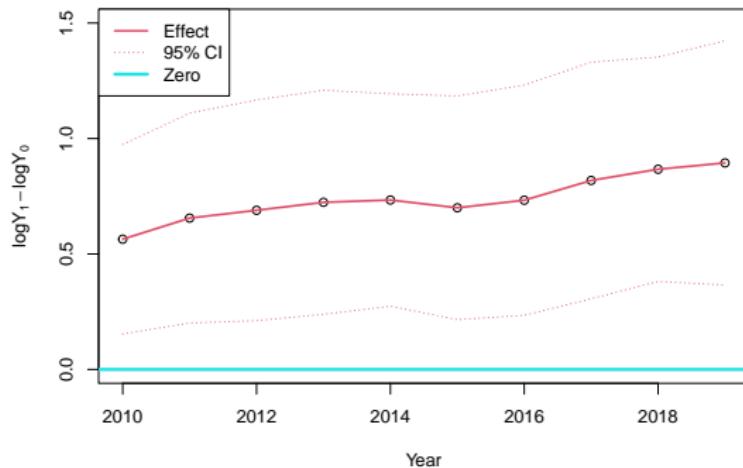


Figure: Effect vs. Year

Results

Table: Average Treatment Effect Averaged over 10 Years

<i>Dependent variable:</i>	
	Incrime
station1	0.738*** (0.076)
Constant	4.533*** (0.053)
Observations	320
R ²	0.231

Note:

* p<0.1; ** p<0.05; *** p<0.01

- ▶ Positive effect of station on local crime
- ▶ Effect on Y is 109.2% ($e^{0.738} - 1$)

Conclusion

Causal channel:

- ▶ Station → Larger commuter flow → More crime opportunities

Three perspectives:

- ▶ Policy-makers: hard to monitor criminal behaviors at stations
- ▶ Criminals: easy to escape at stations
- ▶ Overall: more potential victims and offenders at stations

Thank you for your attention!
Any questions?