The 159th Transport Policy Colloquium
Washington Report XIX

Comments to “The ‘Fiscal Cliff’ Looming for Urban Railroads in the U.S. and Measures Against the Issue“ (Presentation by Mr. Okabe)

Hironori Kato, Dr. Eng.
Department of Civil Engineering
The University of Tokyo

Summary of Mr. Okabe's Presentation

Primary concern: Post-COVID "Fiscal Cliff" looming for US's urban rail

- U.S. transit agencies for urban rail: Serious operating budget shortfall
- State governments: Providing relief funding while imposing conditions such as increasing ridership and implementing cost-cutting measures
- Failure in management improvement → Cutback in funding → Potential scale-down of urban rail services

Hypothetical solution: Private sector participation in rail management

- There have been cases of private-sector involvement resulting in improved management indicators (e.g. Keolis)
- Management improvement← Requiring additional efforts such as public funding and incentives

Questions to Presentation

- **COVID-19's impact on cities**
  - In U.S. cities, rail ridership declined due to COVID-19 pandemic and has not recovered to the pre-COVID level.

    →Is this a factor unique only to U.S.?

  Question: "Is post-COVID recovery generally slower in cities with public transit?"

- **Association of private involvement with operational performance**
  - Private-sector involvement led to better management of urban rail in U.S.

    →Can we extend this finding to other cases of rail management?

  Question: "Do urban rails operated privately have always better operational performance than those run by public sector?"

“Is post-COVID recovery slower in cities with public transit?”

“Impacts of Movement-Restriction Policy under Pandemic on Post-pandemic Urban-Activity Level in Large Cities” Mio Endo (2024), Graduation thesis, Department of Civil Engineering, UTokyo, February 2024

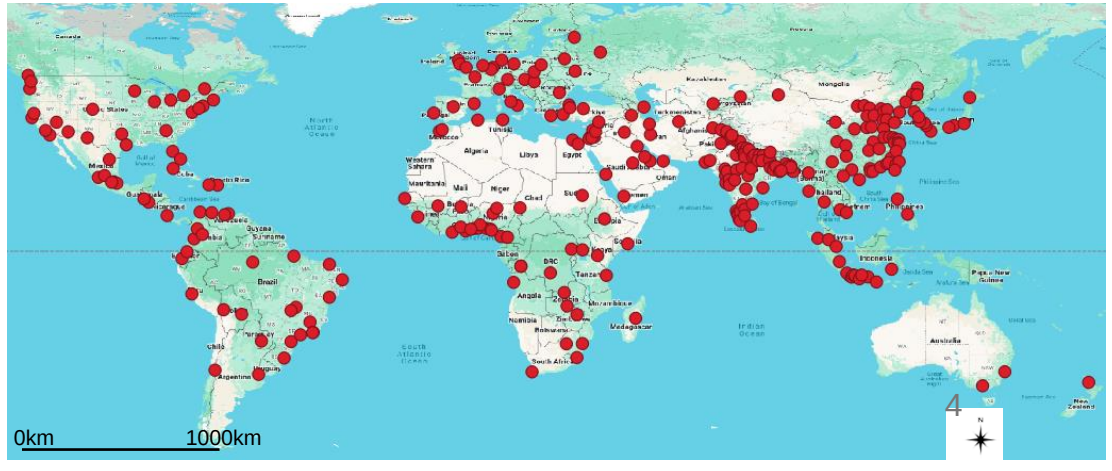
Research Goals

- Identifying changes in the level of urban activities before and after the COVID-19 pandemic at the world’s major cities
- Analyzing the impact of movement-restriction policy on changes in urban-activity level
- Exploring the mechanism and policy implications in the urban activity level in post-pandemic period

Scope

- **Period**：2016 to 2023 (pre- and post- pandemic)
- **Cities: 304 cities with population exceeding 1.5 million**

Distribution of cities with population exceeding 1.5 million as of 2015

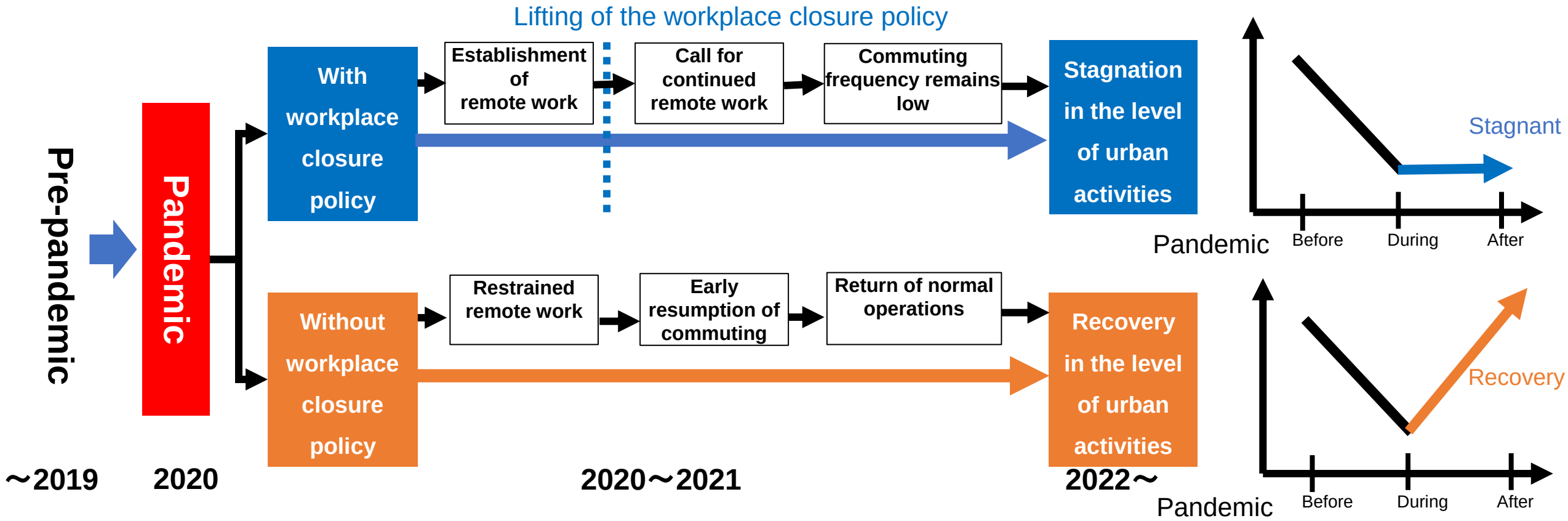


4

Hypothetical Mechanism

How does workplace closure policy affect urban activity level?

Workplace closure policy established remote work as a norm and reduced commuting demand, thereby stagnating urban activities.



The Pandemic reduced the level of urban activities, but the pace of recovery could be different between cities that enforced strong workplace closure policy and those that did not.

Data

Workplace closure policy

Oxford Covid-19 Government Response Tracker Database (2020-2022)

- Global COVID-related policy data in daily unit

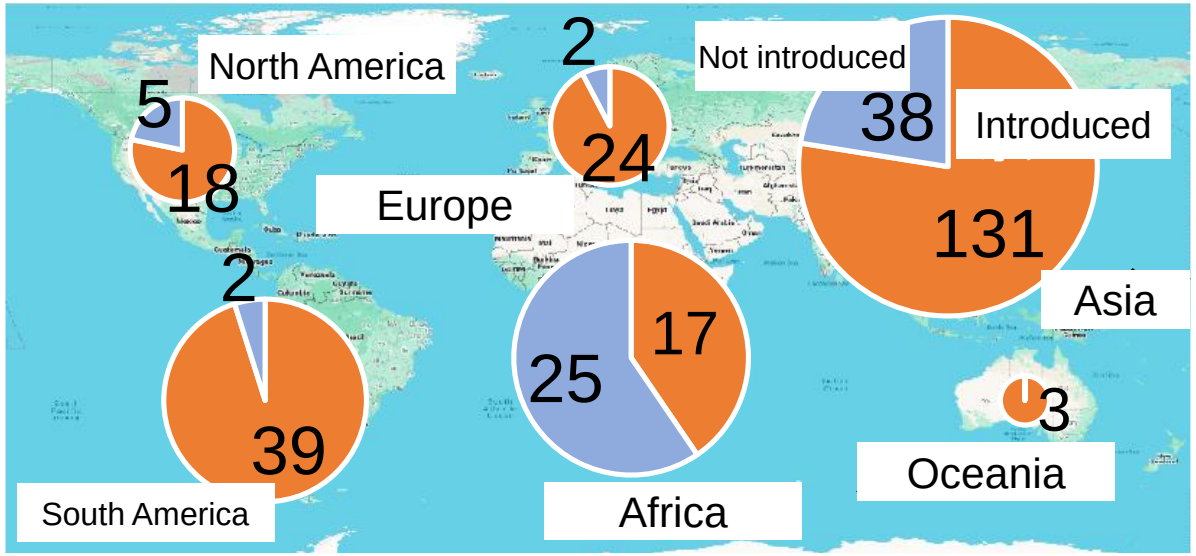
Example:

Workplace closure policy

- Level 1: Closure recommended
- Level 2: Closure requested to some industries
- Level 3: Closure requested to all industries (excluding essential work)

Level 3 cities **232**/304

Ratio of cities that adopted Level 3 policy by region



Level of urban activities

The level of urban activities is assumed to be in proportion to nighttime light intensity (NTL)

VIIRS NTL ver. 2.1/2.2 (2016-2022)

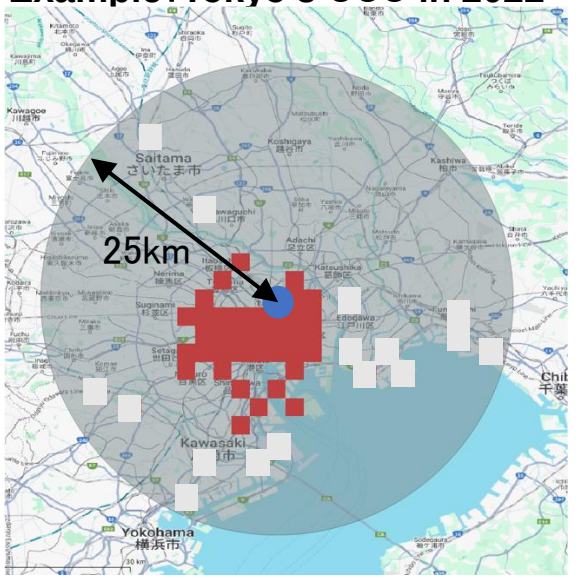
- Annual median NTL observed in 2.5km grids across global land areas
- Widely used as indicator of urban activities (Huang et al., 2017)

City Center Cluster (CCC)

Defining CCC for all cities

- **Central point: Grid with the highest average NTL intensity in 2016-2019**
- **Urban center: 25km radius from the central point** (shown as a grey circle)
- **CCC: An agglomerated grids, including the central point, that represent top 10% in NTL intensity** (shown as a red area)

Example: Tokyo's CCC in 2022



Changes in Urban Activity Level under Workplace-closure Policy

Global trend in transition of urban activity level

Average NTL intensity

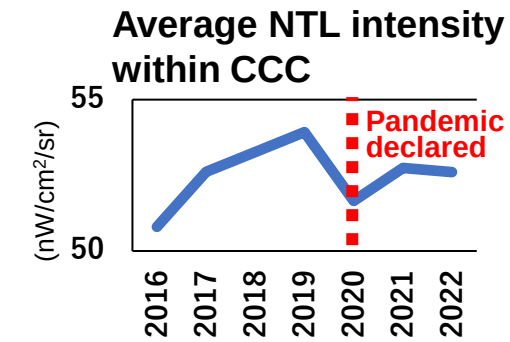
Decline in 2020 but moderate recovery in 2021

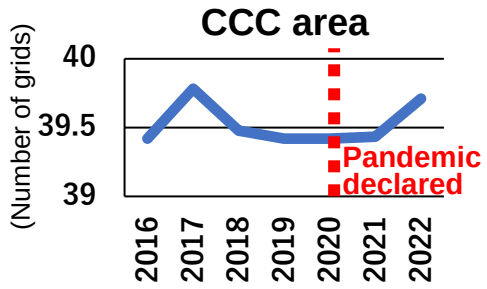
Area of CCC

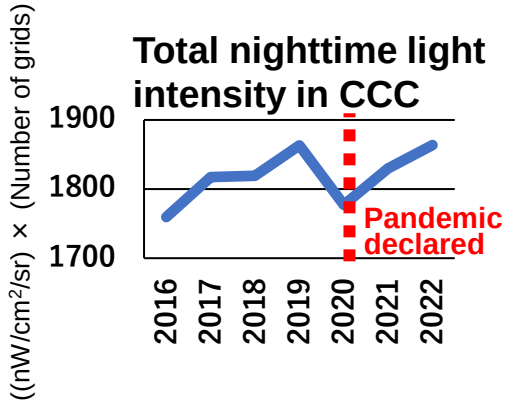
No impact from the Pandemic but increased in 2022

Total NTL intensity

Decline in 2020 but recovered since 2021

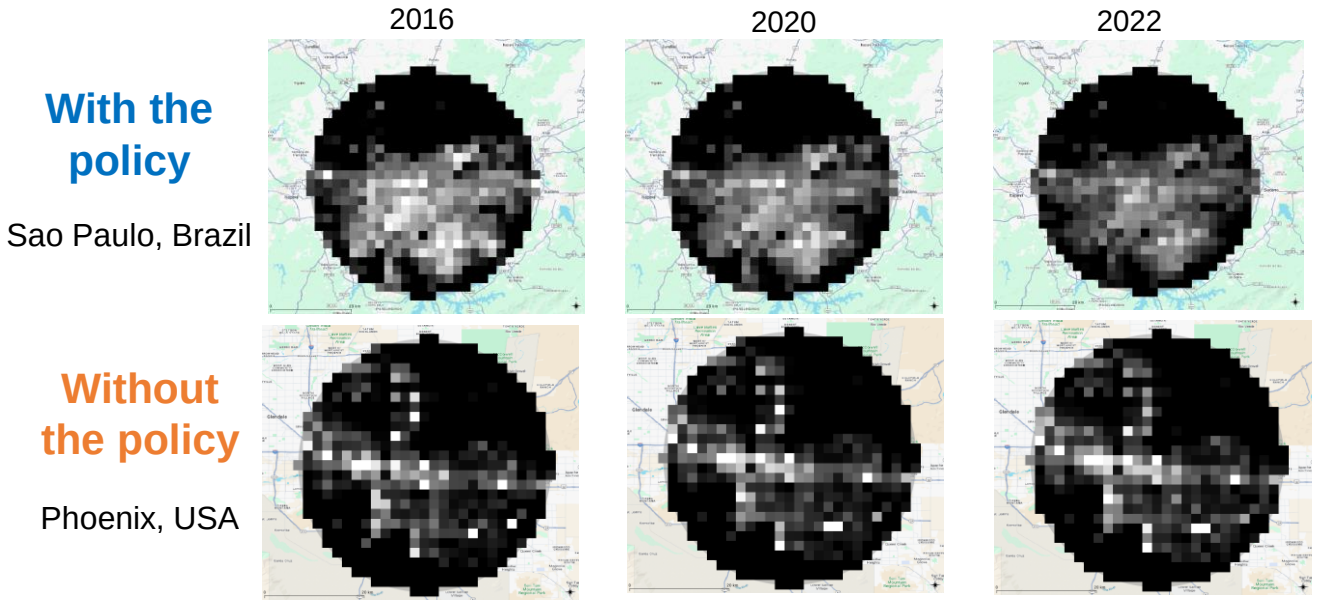




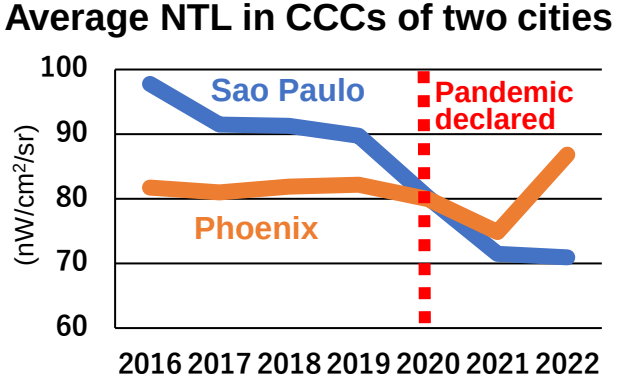


Comparison between cities with and without policy

Comparison between two cities with/without workplace closure policy



Stagnation at the city with the policy. **Recovery trend at the city without the policy**



However,

This is a direct comparison between two cities with grossly different characteristics.

Causal inference analysis

Quasi-experimental Analysis

Quasi-experimental Approach

Empirical analysis of the impact of workplace closure policy on the level of urban activities using matched data

Balance improvement with matching → Estimation of average treatment effect

Balance improvement with matching → Difference-in-differences (DID) analysis

Sample matching

- Treatment group: Cities where Level 3 workplace closure policy was introduced (232 cities)
- Control group: Other cities with population exceeding 1.5 million (72 cities)

Nearest-neighbor matching based on propensity score（Caliper=0.1，sampling without replacement）

Treatment group: 69 cities
Control group: 69 cities

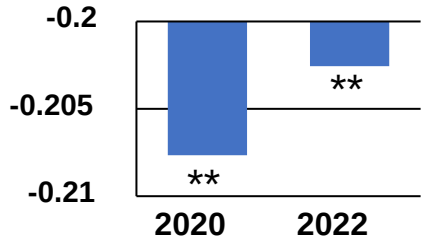
These cities were used for analysis.

Results

Average treatment effect on the treated (ATT)

Comparison of two groups on NTL changes at pre- to post-pandemic

Changes in NTL in CCC vs 2016 level



**: 5% significance

Workplace closure policy has a significantly negative impact on the level of urban activities during and after the pandemic.

Multi-year DID model

Model formulation

$$\ln Y_{ct} = \beta_0 + \beta_1 treat_{ct} + u_c + \lambda_t + \varepsilon_{ct}$$

Y_{ct}: Average nighttime light intensity of City c in Year t,
$treat_{ct}$: Workplace closure dummy, u_c , λ_t : Fixed impact of city and year,
ε_{ct}: Error term

Estimation results（n=966, R^2=0.981)

Variable	Coefficient	T value
$treat_{ct}$	-0.0939***	-2.839
City FE	Yes	
Year FE	Yes	

***: 1% significance

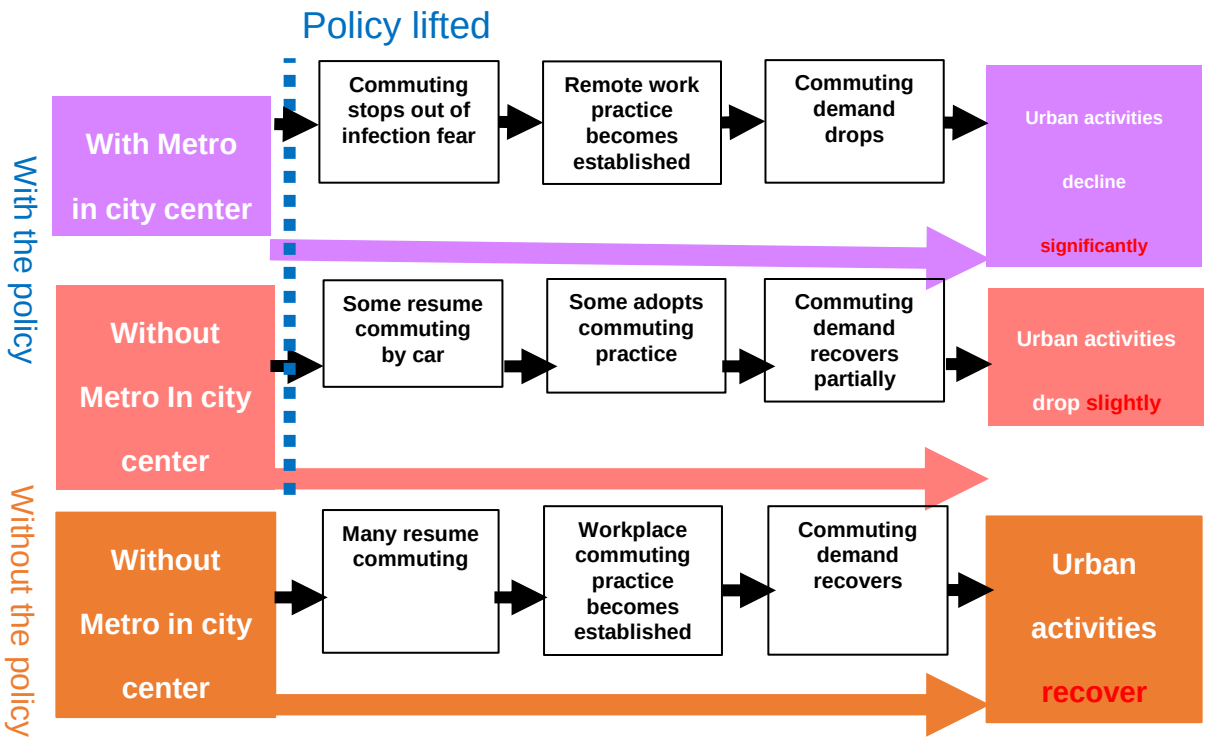
Workplace closure policy significantly reduces the level of post-pandemic urban activities by 9.4%.

Are these results affected by urban characteristics?

Moderating Effect of Public Transit

New hypothesis incorporating PT

PT users avoid commuting even after the policy is lifted as they feel infection risk of PT use is higher



Additional hypothesis

Introduction of workplace closure policy to cities with Metro could significantly lower the level of urban activities.

Results

Difference-in-difference-in-differences (DDD) model

$$\ln Y_{ct} = \beta_0 + \beta_1(treat_{ct} \cdot metro_c) + \beta_2 treat_{ct} + u_c + \lambda_t + \varepsilon_{ct}$$

Y_{ct}: Average NTL intensity, $treat_{ct}$: Workplace closure dummy,
$metro_c$: Metro dummy, u_c , λ_t : Fixed effect

Estimation results (n=966, R^2=0.981)

Variable	Coefficient	T value
$treat_{ct} \cdot metro_c$	-0.0120	-0.266
$treat_{ct}$	-0.0880	-1.886
Urban fixed effect	Yes	
Annual fixed effect	Yes	

The policy's impact on average NTL intensity in cities with Metro

(-0.0120) + (-0.0880)
= -0.1000 **(-10.00%)**

$\beta_1 + \beta_2$'s t value = -3.099 ***

***: 1% significance

In cities with Metro, NTL declined significantly by 10%

However, policy's impact between cities with Metro and cities without was not statistically significant.

“Do urban railroads operated privately have always better operational performance than those run by public sector”

- Review on the performance of urban rail transit (Awad, et al., 2023)

TRANSPORT REVIEWS
2023, VOL. 43, NO. 4, 698–725
https://doi.org/10.1080/01441647.2023.2166146

Performance of urban rail transit: a review of measures and interdependencies

Farah A. Awad [a], Daniel J. Graham [a], Laila AitBihiOuali [b] and Ramandeep Singh [a]

[a]Transport Strategy Centre, Centre for Transport Studies, Department of Civil Engineering, Imperial College London, London, UK; [b]Department of Civil Engineering, University of Southampton, Southampton, UK

Two Perspectives in Assessing Urban Rail Performance (Awad, et al., 2023)

- **Financial aspect = Urban rail's cost efficiency**
  - Production function approach: Total factor productivity (TFP), data envelopment analysis (DEA), etc.
  - Cost function approach

- **Service aspect = Urban rail's service quality (Quality of service)**
  - Objective indicators
  - Subjective indicators

Operational Organization vs. Cost Efficiency

- **Existing studies on the association between private/public sectors versus cost efficiency**
  - Tsai et al. (2015)：Asian and Australian subways have higher technological efficiency than European and North American subways.
  - Qin et al. (2014)：Privately-run urban rails have higher efficiency than urban rails operated by public entities.
  - Costa et al. (2021)：Privately-run urban rails are more efficient than publicly-run urban rails, but this advantage is lost when the GDP growth rate is 1% or greater.
  - Mizutani and Shoji (1997)：Japanese railways have lower operational costs than U.S. railways because many Japanese railways are privately run.

Insights from existing studies

Private-sector participation in urban-rail operation is highly likely to improve its cost performance.

What is unclear?

According to Awad et al. (2023), there are many factors that remain unclear:

- Few studies on the relationship between urban-rail operator's organizational structure and quality of services.
  - "Do private rails always offer a higher quality of service than publicly-run rails?"
- Very little cross-country comparison of urban rails
  - There are hardly any cross-country comparison studies that control uniqueness of operators.
  - "Can we conclude the subway system in Washington DC has better (worse) performance than that in Tokyo?"

International Comparative Study Project on Urban Rail Efficiency by WCTR

- Research project led by the President
- Main objective is to globally compare rail cost efficiency across major cities with urban rail systems.
  - Comparison among cities by region (country)
  - This is one of innovative attempts despite some challenges in method and data

Special session at WCTR2023@Montreal

Cities with efficient urban rails, announced at WCTR2023

Region	Top Efficient City	Most Improved City
Europe	Madrid	Lisbon (2012-2019)
China	Shenzhen	Changsha (2016-2019)
Japan	Kobe	Osaka (2016-2019)
Korea	Gwangju	Daejeon (2016-2019)
India	Hyderabad	N/A*
US / Canada	New York & Toronto**	Miami-Dade (2015-2019)

Conclusions

- **U.S. urban rails have large room for improvement**
  - For example, Washington Metro is likely to face challenges in its service.
- **Pros and cons of promoting urban rails in the U.S.**
  - Although some say bus would be better than rail, bus could deliver even poorer level of service than rail.
- **Expected performance improvement from private-sector participation**
  - Service improvement could enhance urban-rail ridership.
  - However, insufficient evidence on service quality vs. operator's organizational structure.
  - Further empirical study is required.