Enhancing public transport accessibility: Should we use feeder bus or shared-bike system?

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Introduction

Background

Both feeder buses and shared-bikes could be used to address the first-and-last-mile issues. With budget constraints, practitioners should choose the most suitable mode based on travellers' preferences and geographical features.

Study Aims

- Develop a **behaviour model** to explore factors that determine the choice between bus and shared-bike.
- Reveal the interaction between modes to reinforce **sustainable transport.**
- Identify suitable feeder service for each area to improve public transport **accessibility**.

Literature & Research Gap

Literature Review

- Shared-bike can increase public transport accessibility and support flexible mobility. It has been widely used to complement public transport.
- Shared-bike can reduce private vehicles and taxi use in most urban areas. The travel pattern of users shifting toward public transport due to shared-bike depends on the socio-demographic features.
- Shared-bike may also replace conventional public transport, causing a slight decrease in bus ridership.
- Mode choice between bus and shared-bike in terms of last-mile connection of railway trips is associated with travel time and the existence of biking facilities.

Research Gap

- The choice between shared-bike and bus as a feeder service is largely unexplored.
- This study aims to develop evidence-based transport planning strategies for feeder services in urban areas.

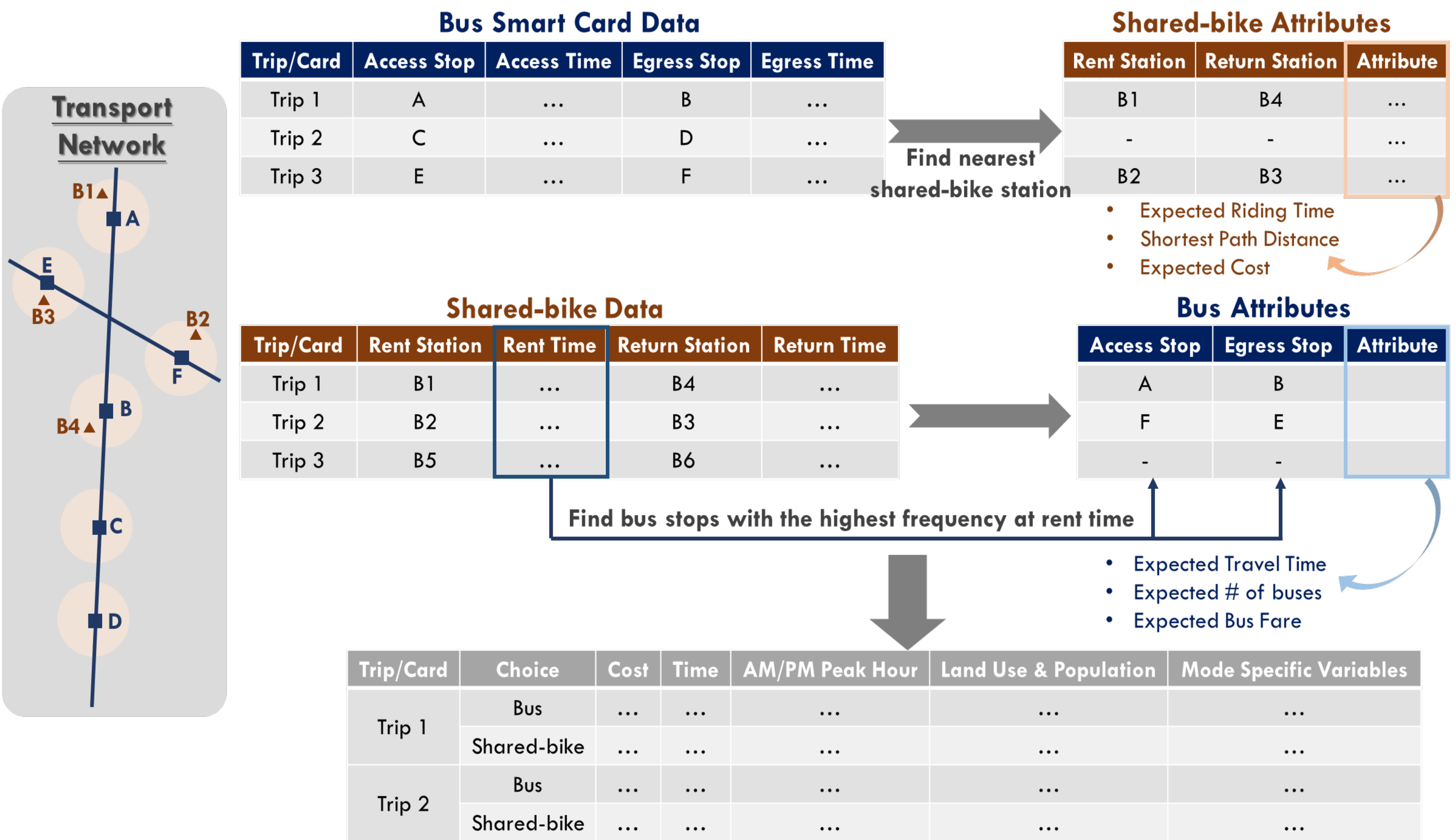
Methodology

Data Collection

Dataset	Purpose	Source
Smart Card Data	OD analysis	Taipei Transport Bureau
Transport Data	Find the overlapping service area of modes	Transport Data eXchange (TDX)
Land Use Data	Explanatory variables of mode choice	Social Economic GIS (SEGIS)
Population Data		

Time Frame: March, 2023

Data Wrangling



Modelling Approach

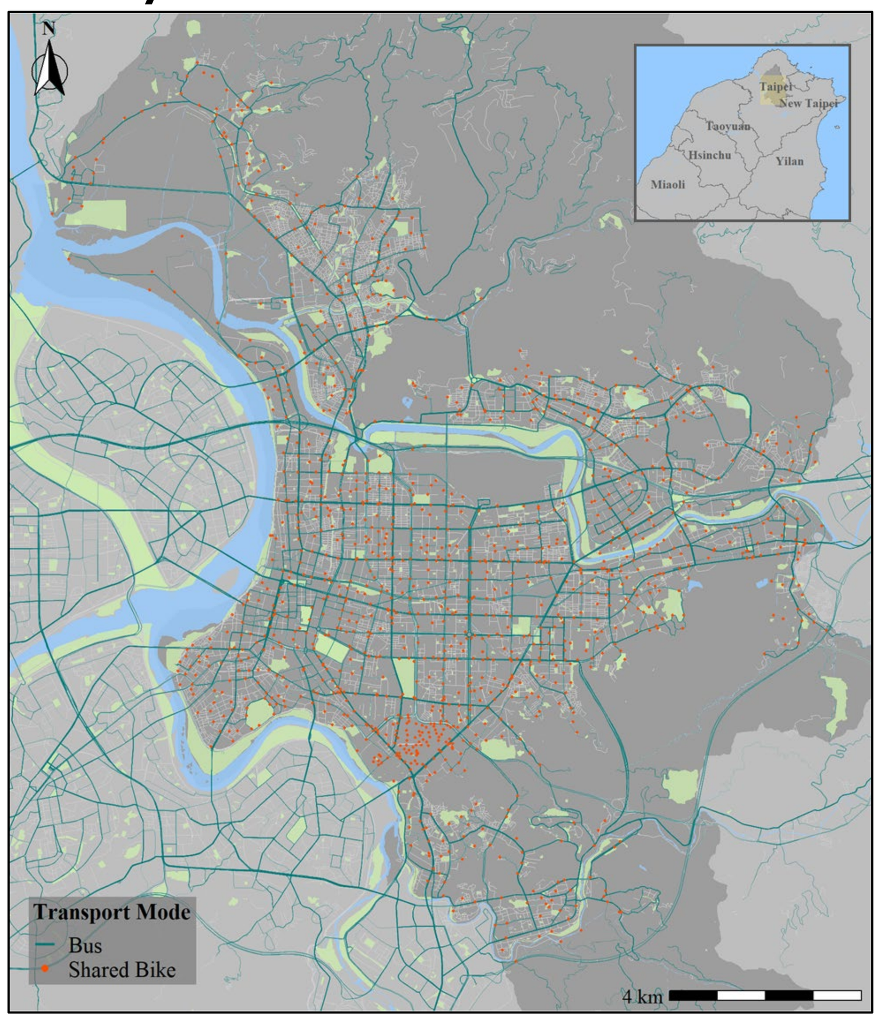
$$P(Shared-bike) = \frac{e^{V_{Shared-bike}}}{e^{V_{Bus}} + e^{V_{Shared-bike}}}$$

V_{Bus} **Generic** + **Bus Specific**

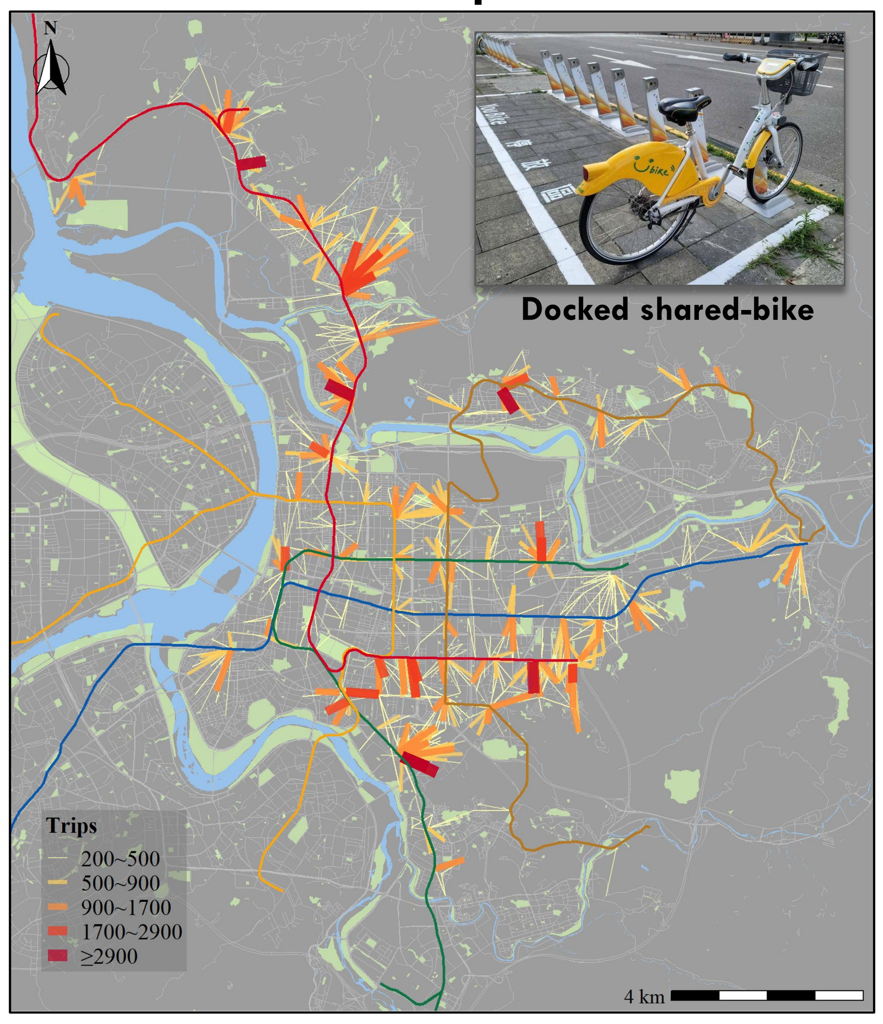
$V_{Shared-bike}$ **Generic** + **Shared-bike Specific** + **Socio-demographic & Land Use** + **Temporal**

Descriptive Analysis

Study Area



Shared-bike Riderships



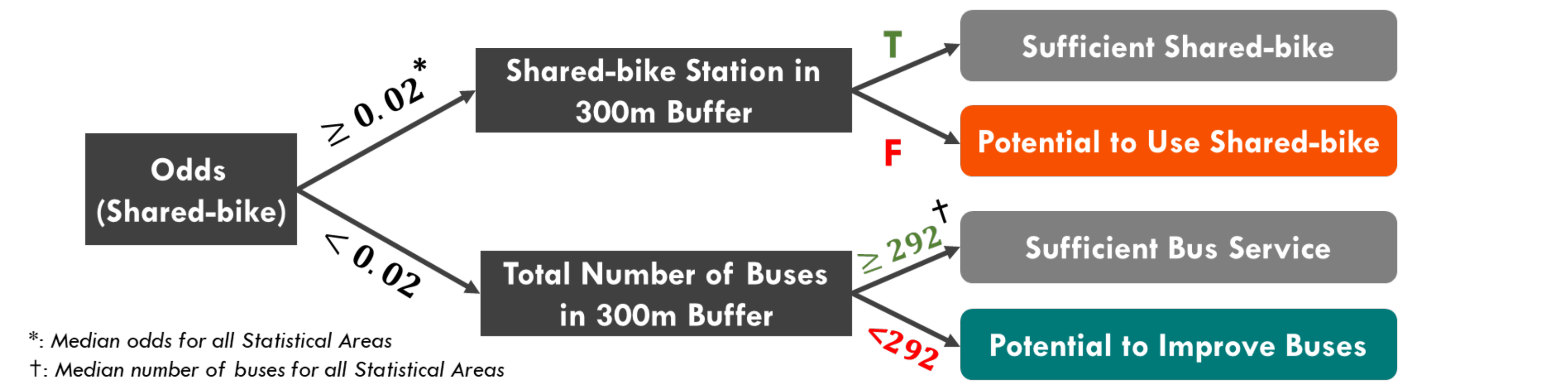
- Trips of shared-bikes are associated with MRT services.
- The service areas of shared-bikes and buses are highly overlapped.

Initial Model Result

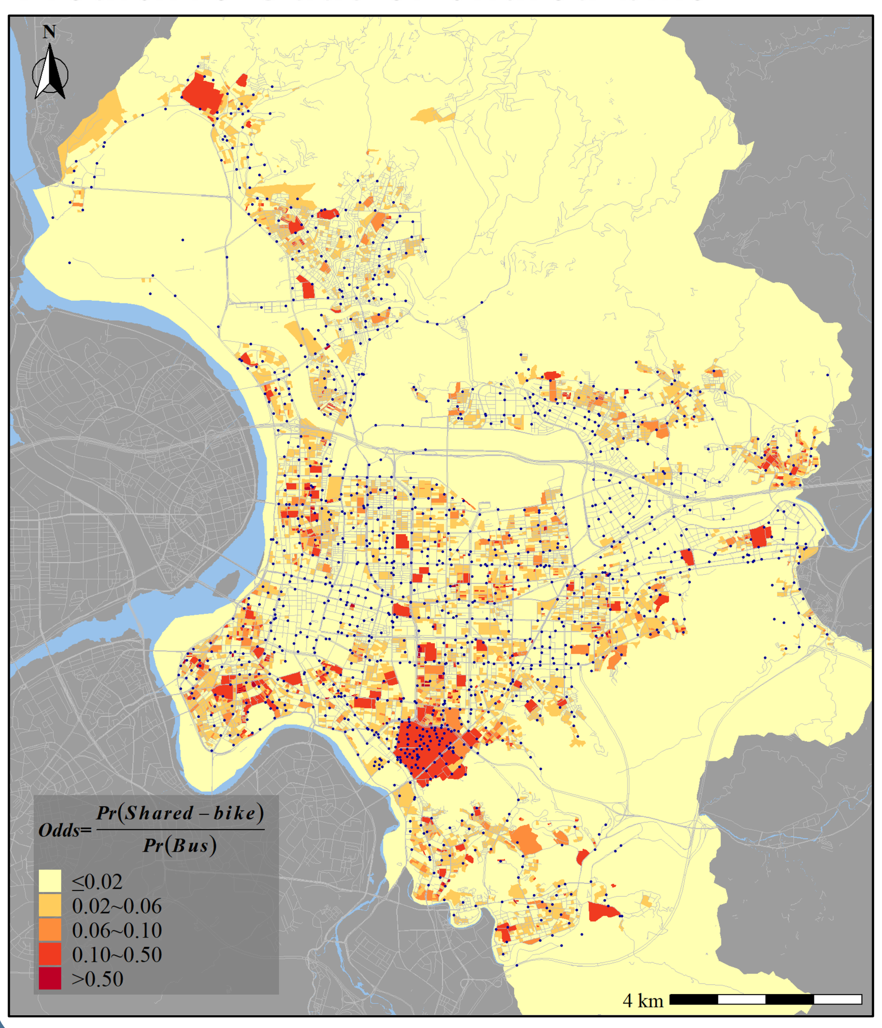
Variables	Coefficient	z-statistic	Marginal Effects
Constant (Shared-bike)	-1.784	-19.764***	-
Generic Variables			
Travel Cost	-0.222	-54.66***	-0.01
Travel Time	0.020	2.456***	0.001
Shared-bike Specific Variables			
Cycling Distance (km)	-1.321	-45.476***	-0.058
Average Bike Availability at Rent Station	0.035	19.364***	0.002
Average Dock Availability at Return Station	0.020	17.901***	0.001
Bus Specific Variables			
Number of Buses when departure	0.497	44.332***	0.022
Socio-demographic & Land Use Variables			
Population Density	0.027	19.139***	0.001
Proportion of Commerce Area	-0.005	-1.776**	0.000
Proportion of School Zoning Area	0.042	25.008***	0.002
MRT Service in 300 Meters Catchment Area	0.088	2.370***	0.004
Proportion of Cycling Path	0.003	1.544*	0.000
Temporal Variables			
Depart in Morning Peak Hour	-0.140	-3.565***	-0.006
Depart in Evening Peak Hour	0.125	3.446***	0.006
Depart at the weekend	-0.111	-3.064***	-0.005
# of Samples		100,000	
$LL(C)$		7,576.922	
ρ_C^2		0.3225	

Note: *** $p<0.01$; ** $p<0.05$; * $p<0.1$

Discussions & Conclusions



Predictive Odds of Shared-bike



Potential Mode Map (SA1)