
Transportation policy analysis by stated and revealed choice data collected in Phnom-Penh

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Background and purpose

The history of bus services

2014

Bus started

2015

Expansion of bus route

2017

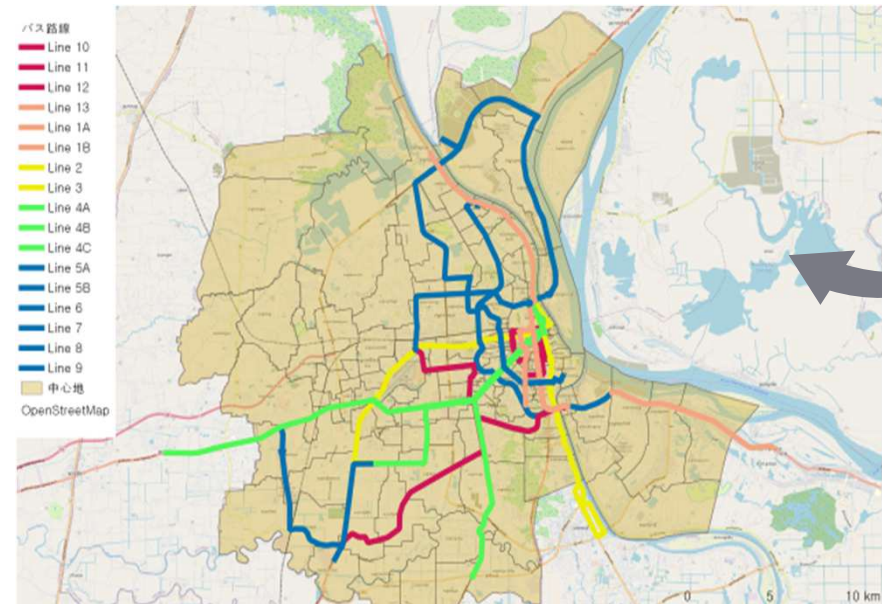
Re-expansion of bus route

2019

13 line are on service



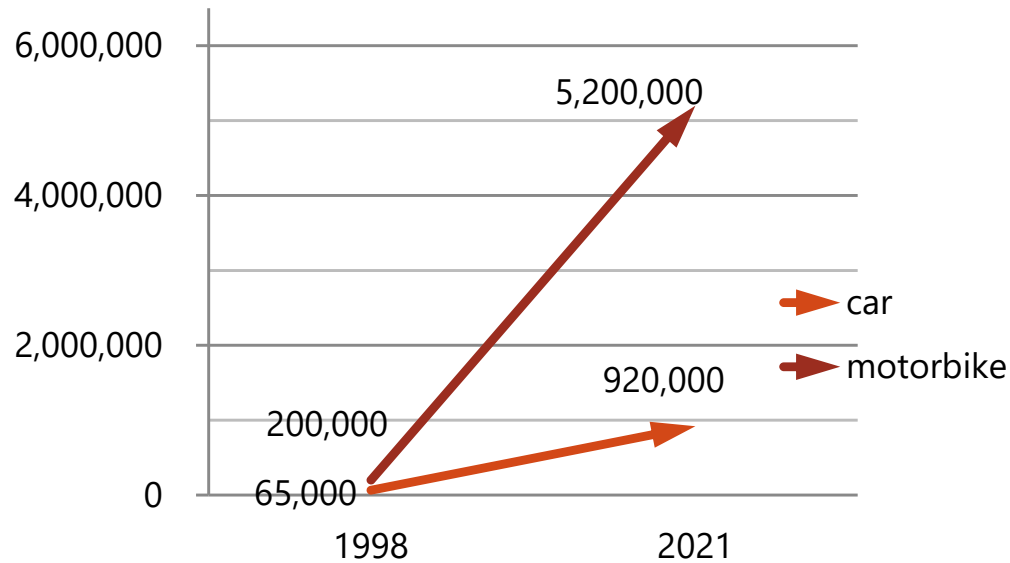
bus users (2019/10)



Central Phnom-Penh and bus lines

Low modal share of bus
8/8223trip (2022PT survey, JICA)

-Rapid spread of automobile and motorbike-



The number of registered vehicle

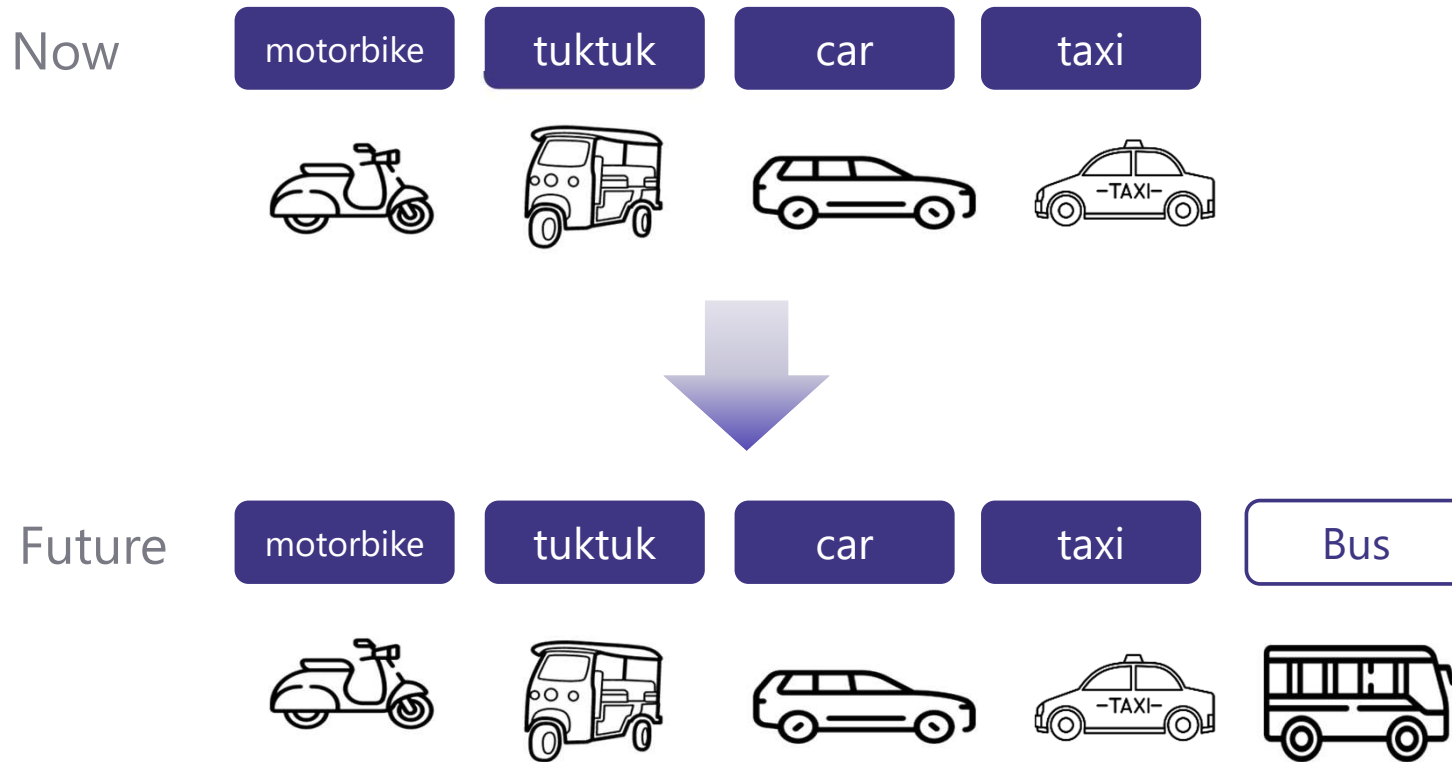


Traffic congestion in Phnom-Penh

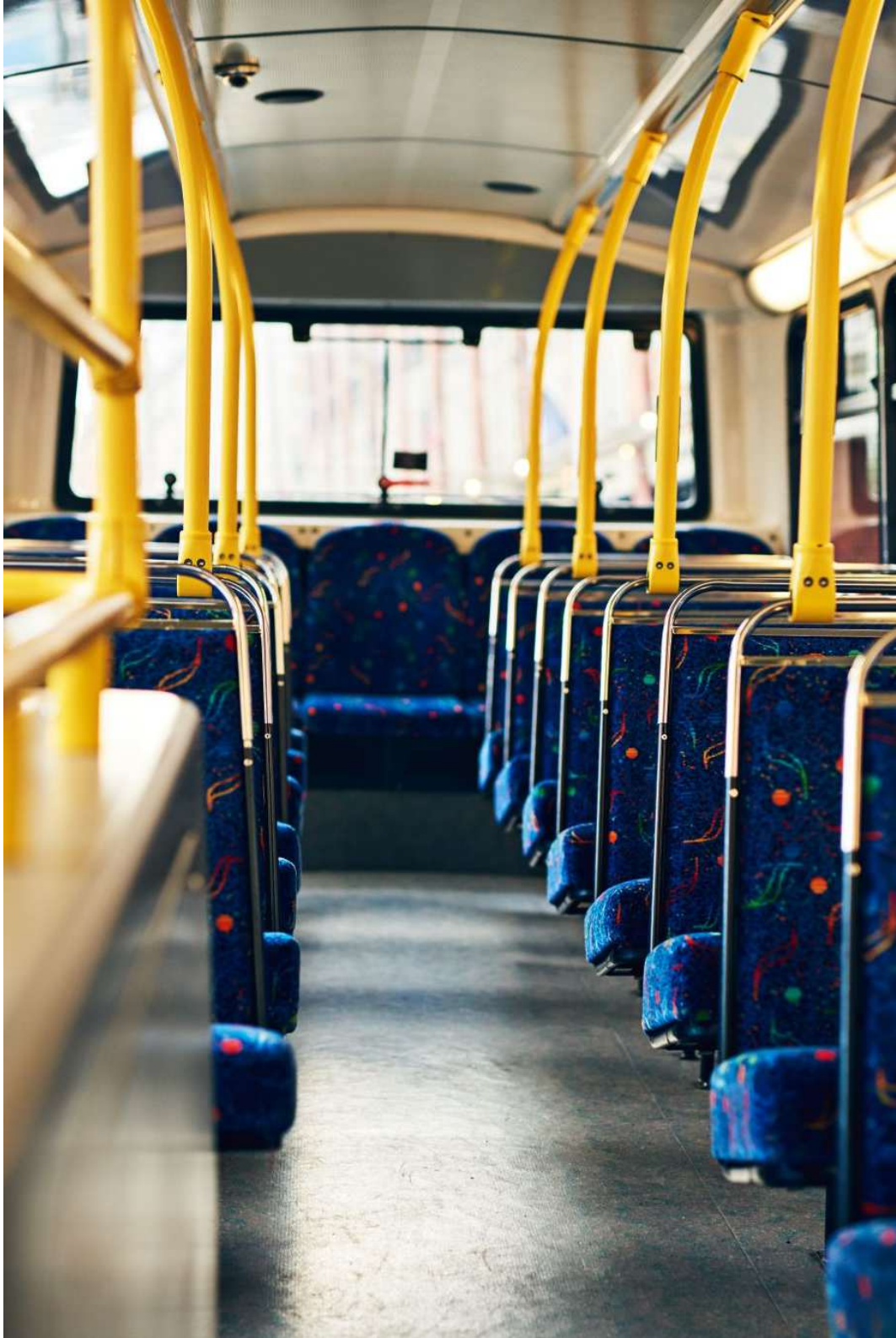
300,000~400,000 increase every year

Traffic safety is one of the serious problems other than traffic congestion

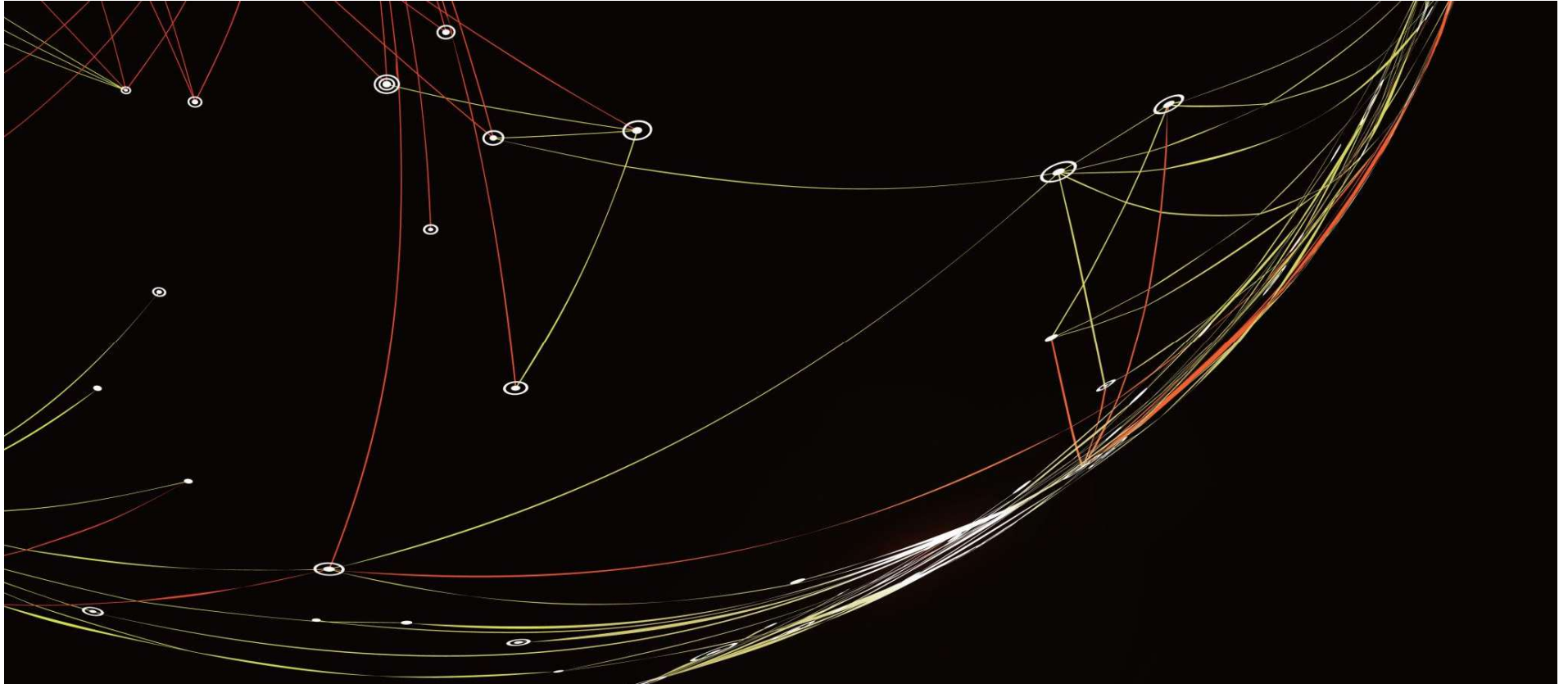
The purpose of this study



What kind of policy is effective to promote bus use?



Why Bus?



Outline of this analysis

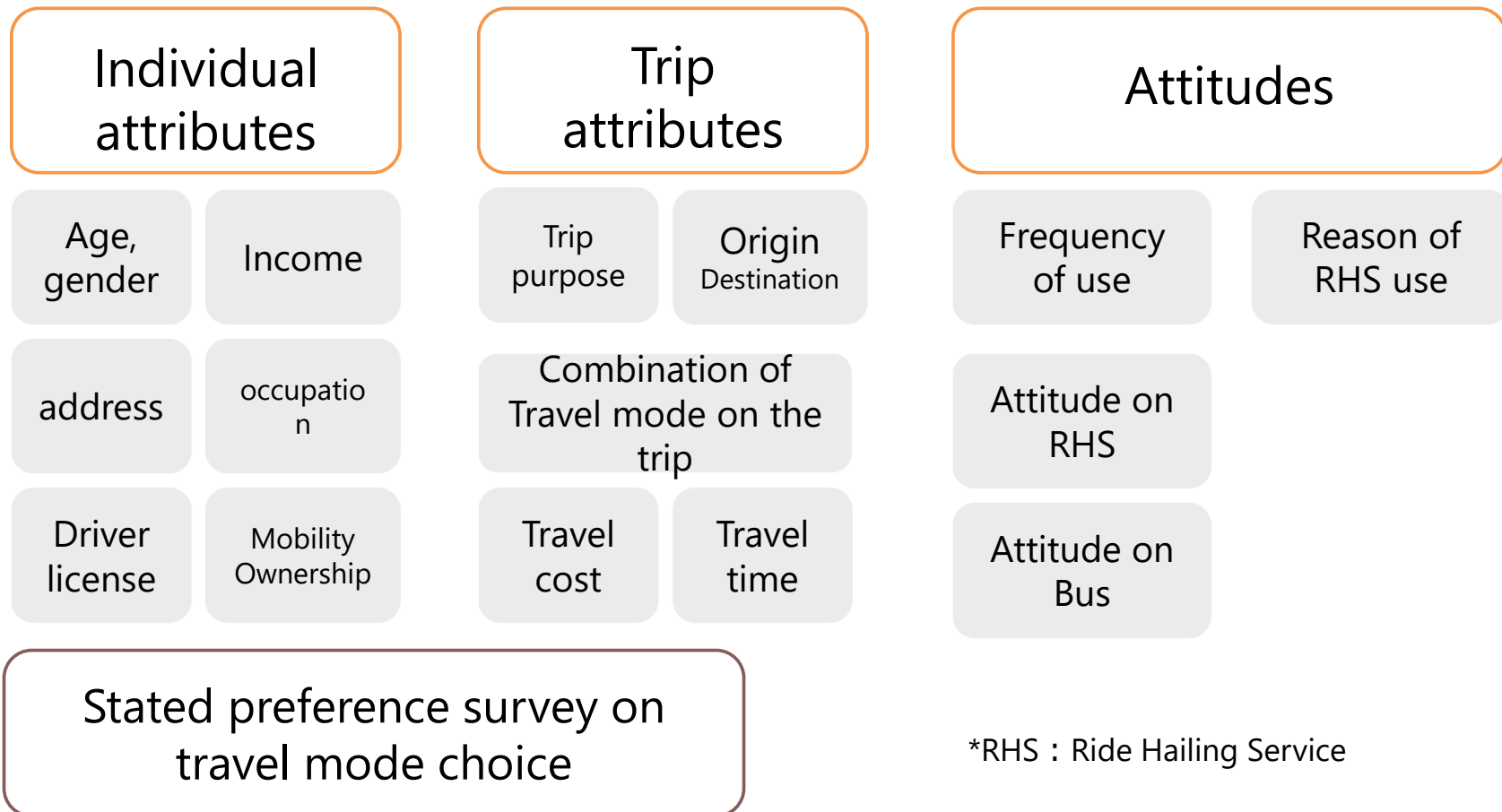
The data used

- RHS uses' interview data
- Person Trip survey data

	RHS user survey	PT survey
Year of survey	2021	2022
Number of samples	517 persons	3006 persons (8223 trips)
Individual attributes	Gender, age, income, mobility ownership (automobile, motorbike), license holder etc.	
Trip attributes	Travel mode, chain of travel mode, Travel time, Travel cost, Trip purpose, Drive or passenger	
	Origin and Destination of trips	Origin, Destination
Stated choice data	The reason of RHS use The reason not use bus Stated intention of bus when either e-bike or Tuktuk can be used as access mode to bus	

RHS user data

Survey respondents: 517 Tuktuk users



*RHS : Ride Hailing Service

SP survey in RHS user survey

- Stated choice questionnaire
- Short range and long-range trip
- Cost: 8 condition was shown



- ➔ 8×2 responses are inquired on each respondents
 - The different alternatives are set on car owners and non-car owners
 - Cost and travel time is set on each combination of origin and destination

Example; car owner, short range trip

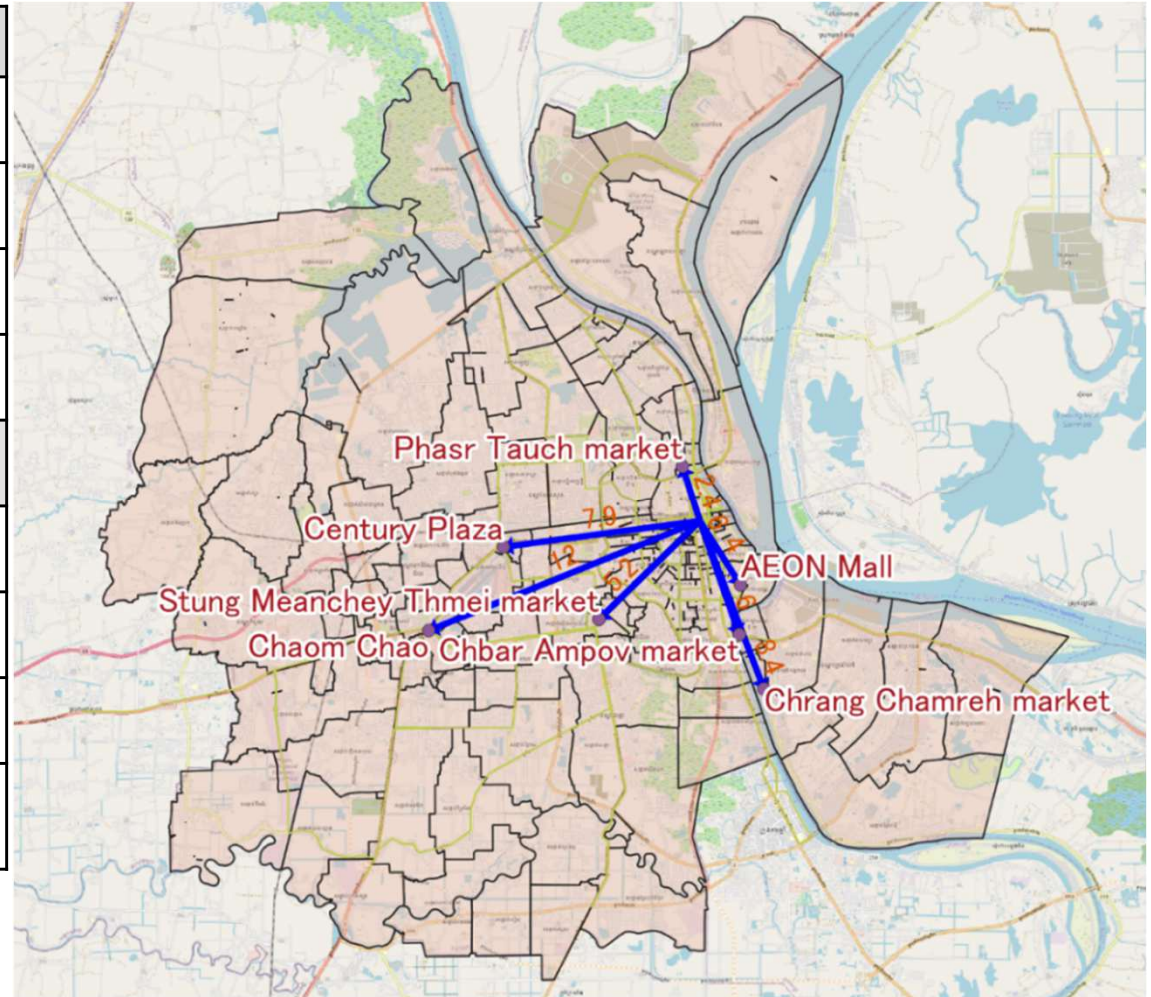
Which travel mode do you prefer at the same purpose on Central Market to Phsar Tauch Market?

ALT	Selection (from 1 to 5)	1. Car*		2. Motorbike*		3. Tuk-Tuk		4. Bus		5. Urban Railway	
		Time(min)	Cost(Riel)	Time(min)	Cost(Riel)	Time(min)	Cost(Riel)	Time(min)	Cost(Riel)	Time(min)	Cost(Riel)
1		40	2,700	48	1,300	60	22,000	48	1,500	28	1,500
2		60	2,700	48	1,300	90	22,000	72	1,500	34	1,500
3		60	2,700	48	1,300	90	22,000	48	1,500	28	6,000
4		40	2,700	48	1,300	60	22,000	72	1,500	34	6,000
5		40	2,700	48	1,300	90	22,000	72	1,500	28	11,000
6		60	2,700	48	1,300	60	22,000	48	1,500	34	11,000
7		60	2,700	48	1,300	60	22,000	72	1,500	28	16,000
8		40	2,700	48	1,300	90	22,000	48	1,500	34	16,000

* Car and Motorbike can be selected only when owned by household

Four groups of respondents

Group	Short range trip	
A	Phasr Tauch market	2.4km
B	AEON Mall	4.0km
C	Century Plaza	7.9km
D	Deun Kor market	2.5km
Long range trip		
A	Chrang Charmreh market	8.4km
B	Chber Ampov market	6.0km
C	Chaom Chao	12.0km
D	Stung Meanchey Thmei market	5.2km



Outline of PT survey

Year 2022

Respondents 3006 person in Phnom Penh

Individual attributes

Gender, age

Income

Resident location

Occupation

License holder

Car ownership

Trip Attributes

Trip purpose

Origin and Destination

Combination of travel mode

Travel cost

Travel time

Basic analysis of data

The background features a dark blue and black color scheme with abstract data visualization elements. A white line graph with three yellow circular data points is visible. There are also vertical blue lines and a faint grid pattern. The text 'Basic analysis of data' is prominently displayed in white.

(1) CHARACTERISTICS OF SOCIAL ECONOMY

(2) CHARACTERISTICS OF TRIP

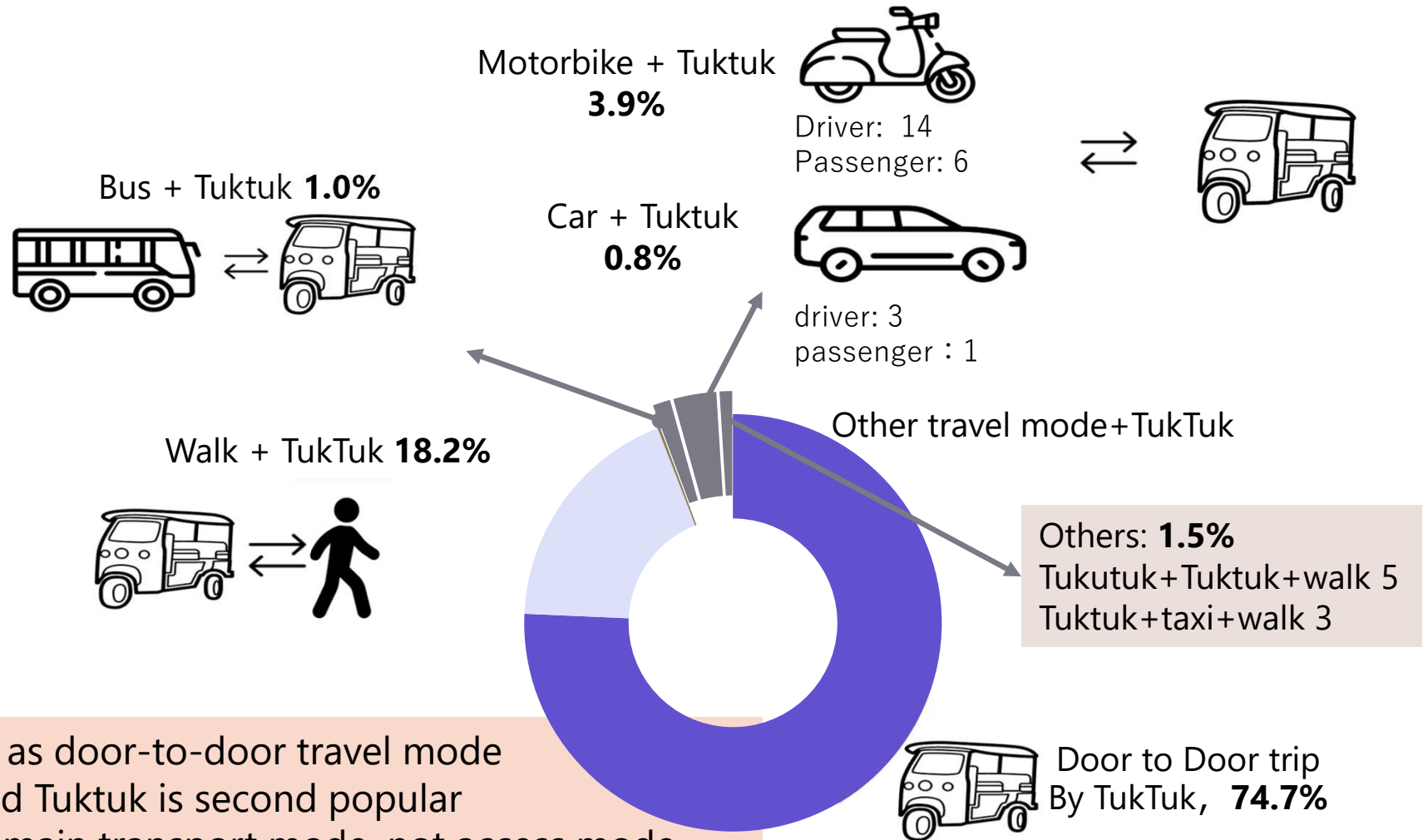
(3) AGGREGATION OF ATTITUDE INDICATORS

Socio-economic characteristics of RHS users and PT survey

- Those who use RHS is younger generation
- Female may prefer RHS than male
- higher income (more than \$250)
- Owning motorbike

Age			Income \$			Occupation		
	RHS	PT		RHS	PT		RHS	PT
-20	16.4%	29.4%	-249	7.0%	55.2%	student	30.6%	30.5%
20-29	52.6%	16.5%	250-499	19.0%	29.9%	worker	60.2%	59.0%
30-39	20.3%	22.6%	500-999	48.0%	12.5%	non-worker	0.8%	2.1%
40-49	5.6%	14.2%	1000-1999	19.1%	2.0%	others	8.5%	7.4%
50-59	3.5%	10.5%	2000-	3.7%	0.4%			
60-	0.6%	6.7%	other	3.5%	-			
Gender			Motorbike			Car		
	RHS	PT		RHS	PT		RHS	PT
Male	38.9%	51.1%	Own	96.7%	98.7%	Own	38.5%	42.5%
Female	61.1%	48.9%	other	3.3%	1.3%	other	61.5%	57.5%

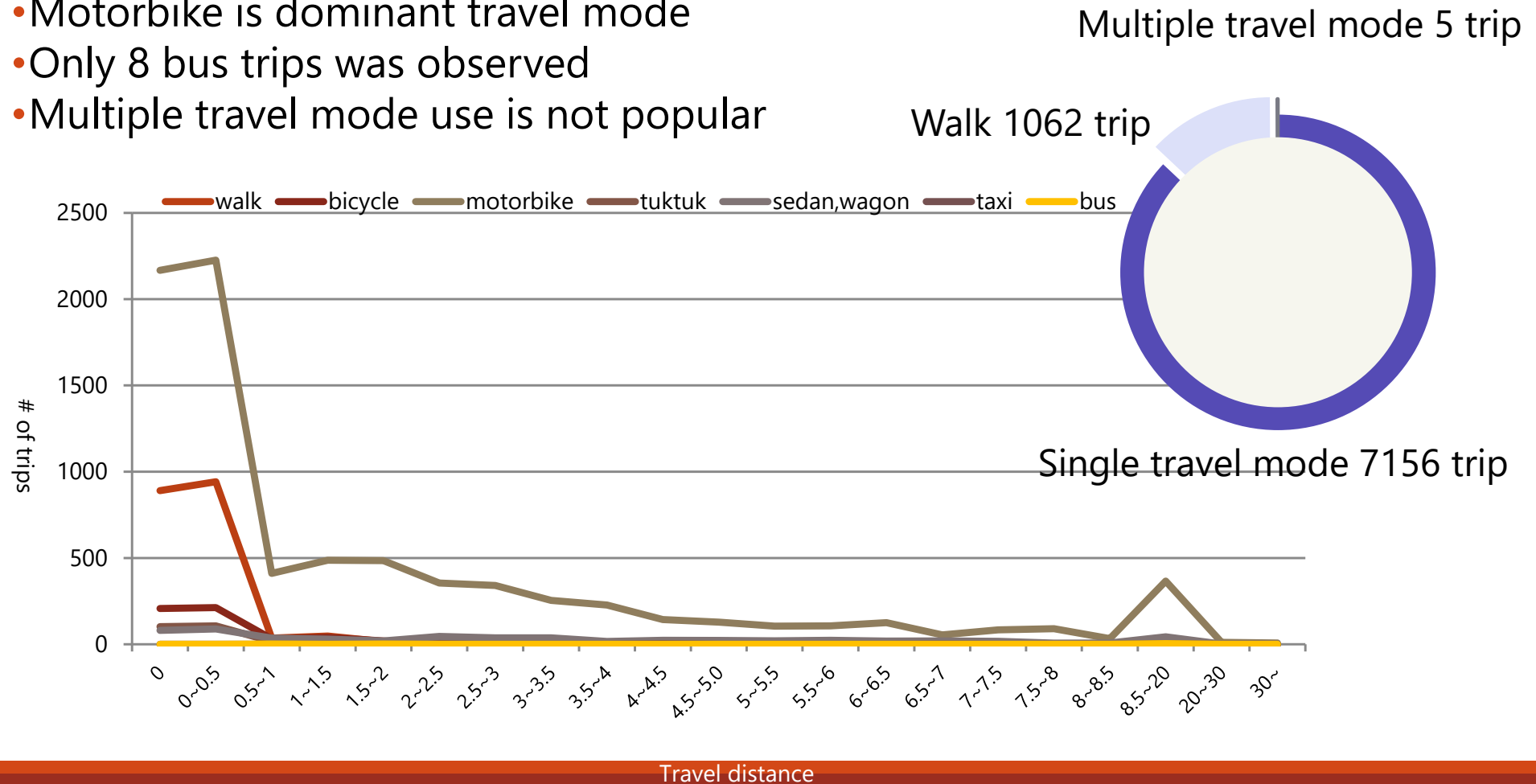
Characteristics of Tuktuk users



They use tukutuk as door-to-door travel mode
 Private vehicle and Tuktuk is second popular
 Tuktuk is used as main transport mode, not access mode

Trip characteristics of PT survey

- Short trip within 1km is dominant
- Motorbike is dominant travel mode
- Only 8 bus trips were observed
- Multiple travel mode use is not popular



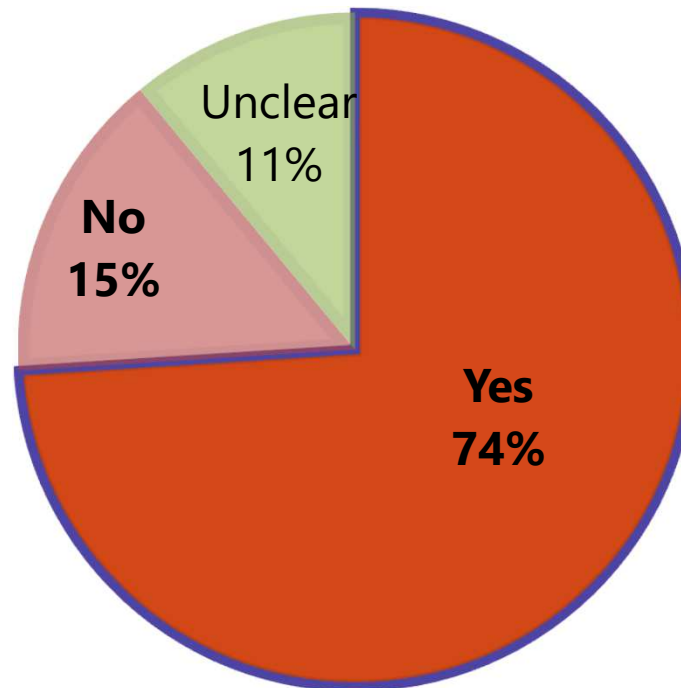
Attitudinal indicators for RHS

	The reason of RHS Tuktuk use	responses	Percentage
	No need to walk	198	38.3%
	Convenient reservation system	195	37.7%
	Easy to use	89	17.2%
	No need to search route	98	19.0%
Convenience	No need to explore parking	92	17.8%
	Bad weather	72	13.9%
	No need to transfer	43	8.3%
	No available vehicle	78	15.1%
	No bus service close there	15	2.9%
	traffic safety	187	36.2%
security	criminal security	77	14.9%
	Low risk of infection	11	2.1%
Payment	reasonable fare	220	42.6%
	easy payment	63	12.2%
	faster than others	63	12.2%
travel time	short waiting time	67	13.0%
	easy to keep schedule	130	25.1%
	others	6	1.2%
		1704	517

The reason of RHS tuktuk use

Bus use intention on accessibility improvement

Do you think you will use bus more, if you can use e-bike and RHS as access mode to bus stop?



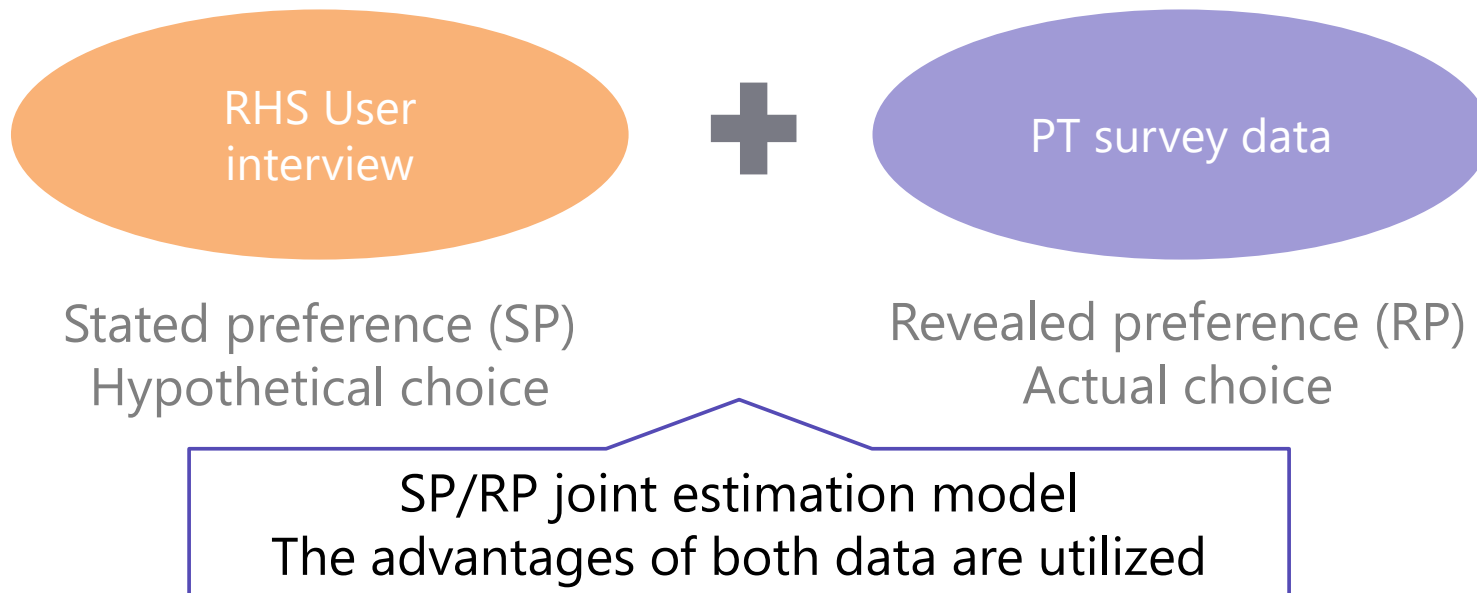
Estimation of travel mode choice model

MODEL STRUCTURE

VARIABLE SELECTION

ESTIMATION RESULTS AND IMPLICATION

The model structure



Disadvantages of RP data: the choice situation might be restricted and correlated, so that the parameters are not clearly identified

Advantage of SP data: the conditions can be controlled, so that the trade-off of the variables can be clearly identified.

Disadvantage of SP data: the credibility. Due to the hypothetical situation, the choice results are sometimes biased.

The concept of RP/SP joint model

Based on the characteristics of SP and RP data, it is better to assume the variance of random term is different.

μ : indicator of variance \longrightarrow not identical

U : Utility of alternative, V : Systematic part of utility, ϵ : random part of utility

$$U = \mu \cdot V + \epsilon$$

$$U^{SP} = \mu_{SP} \cdot V^{SP} + \epsilon^{SP}$$

$$U^{RP} = \mu_{RP} \cdot V^{RP} + \epsilon^{RP}$$

$$\mu_{SP} \neq \mu_{RP}$$



$\mu_{RP} = 1,$
 μ_{SP} to be estimated

Estimation
result of
RP/SP model

variables	alternative	estimates	t-statistics
	bus	-4.83	-8.7
alternative specific constant	car	-2.79	-11.2
	motorbike	3.1	29.1
	taxi	-2.65	-17.7
travel time	all	-0.007	-3.6
travel cost	all (SP)	0.000	1.1
driver dummy	car (RP)	8.06	28.1
female dummy	car, Tuktuk, Taxi	0.545	6.2
age under30	motorbike	0.608	6.3
age 40-60	car	0.518	1.9
age 40-60	motorbike	-0.414	-3.3
age over 60	bus	-0.476	-0.3
age over 60	Tuktuk, taxi	0.379	1.8
student dummy	bus	0.121	0.3
public servant	bus	1.26	1.7
income under 250	bus	4.54	12.5
income over 500	Tuktuk, taxi	-0.669	-1.7
income over 500	car, motorbike	0.159	0.4
Motorbike owner dummy	motobike (SP)	-3.16	-18.2
Short waiting time	bus (SP)	0.893	5.4
Short waiting time	Tuktuk, taxi (SP)	-0.497	-3.0
access improvement	bus (SP)	0.662	3.9
Scale parameter	SP	0.44	16.4
	ρ^2		0.47

Age

under 30
motorbike

40-60
Car but not motorbike

over 60
non drive mode

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Gender

Female

car, Tuktuk and Taxi
Privacy protected
travel mode

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Income

under \$250
Bus

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Attitude

Bus

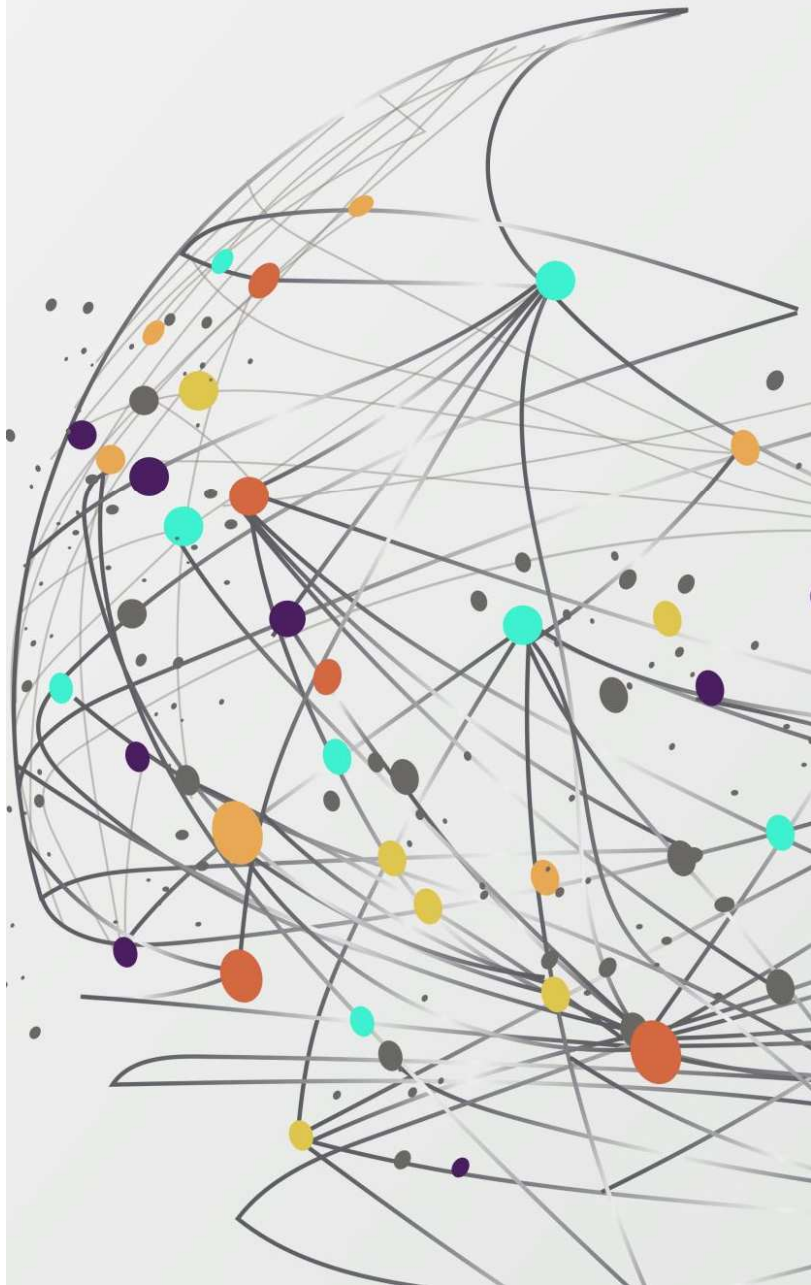
Short waiting time
Access to bus stop

variables	alternative	estimates	t-statistics
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Elasticity of mode share on travel time

- Younger generation have more importance on travel time
- Even though the travel time of motorbike would become longer at 10%, the mode share of motorbike and bus does not change drastically

	Motorbike	Bus
Mode share change on 10% longer travel time of motorbike	-1%	+1.5%



Conclusion

Summary and conclusion

Socio economic factors

- Younger generation prefer faster travel mode, while 40-60 years old generation prefer comfortable travel mode
- Over 60 years old and female prefer privacy-friendly travel mode
- Under average income strata, the cheaper travel mode is preferable

Attitudes

- Those who choose short waiting time have potential user of bus
- Access improvement is the condition to use bus

Trip attributes

- Regarding the elasticity of travel time change of motorbike, the mode share is not severely affected

- **What is necessary to promote bus use?**
- Rapid bus will be the key
- Comfortable and security
- Low-income household
- Access and frequency
- The mobility management that influence on the attitude is necessary

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Questions?

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