複数交通手段のサブスクリプション型サービスが交通手段選択に及ぼす影響分析

Evaluation of the effect of subscription services of the multimodal transportation modes on mode choice behavior

Kobe University

Kenji Ikeda, Masayuki Kuchii,
Kazuya Fukushima, Taiga Matsubara

Background & Purpose

- Recently, subscription services of multimodal transportation modes are provided as Maas.

Whim to Go **Pay as you go**		Whim Urban 30 **€59,7** / 30 days
Pay as you go	Public transport	HSL 30-day ticket
Not included	City bike	Unlimited
Pay as you go	Taxi (5km)	€10
Pay as you go	Rental car	€49/day

"Pay as you go" vs "subscription" (Whim App)

- Analyze the effect of subscription services of multimodal transportation modes on mode choice behavior.

Analysis Procedure

Data cleaning of "豊洲" PP

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Parameter estimation of mode choice models (MNL, CNL)

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See the changes in choice probabilities
when introducing subscription services.
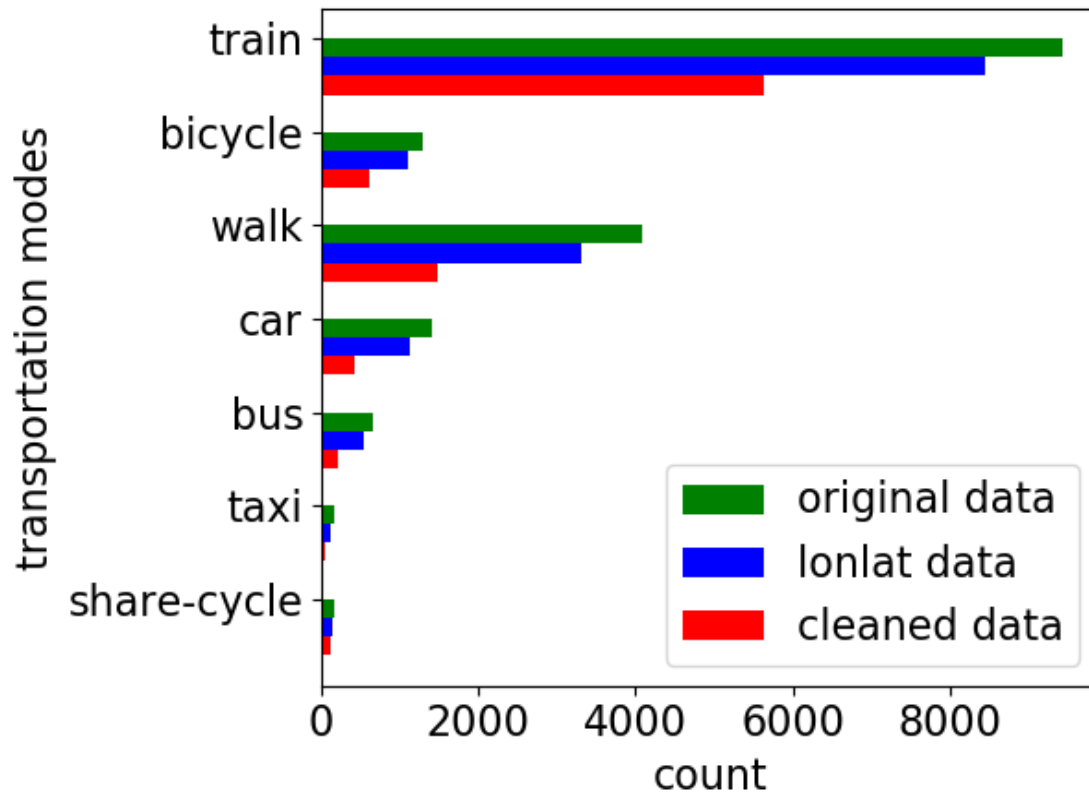
豊洲 PP data

Original
17600 trips

→ (Remove trips storing *NA* in lon, lat.)

15079 trips

→ (Google API
Yahoo! 乗換案内
NAVITIME乗換案内)

Clean dataset
8520 trips

Mode choice model (MNL)

$$V_{Walk} = \beta_1 x_{time} + \beta_2 x_{cost}$$

$$V_{Bicycle} = \beta_B + \beta_1 x_{time} + \beta_2 x_{cost}$$
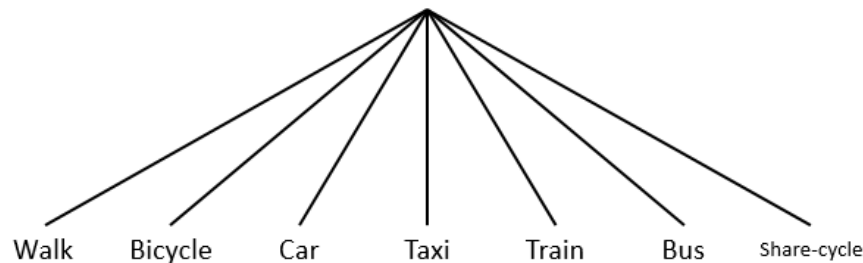
$$V_{Car} = \beta_C + \beta_1 x_{time} + \beta_2 x_{cost}$$

$$V_{Taxi} = \beta_X + \beta_1 x_{time} + \beta_2 x_{cost}$$

$$V_{Train} = \beta_T + \beta_1 x_{time} + \beta_2 x_{cost}$$

$$V_{Bus} = \beta_B + \beta_1 x_{time} + \beta_2 x_{cost}$$

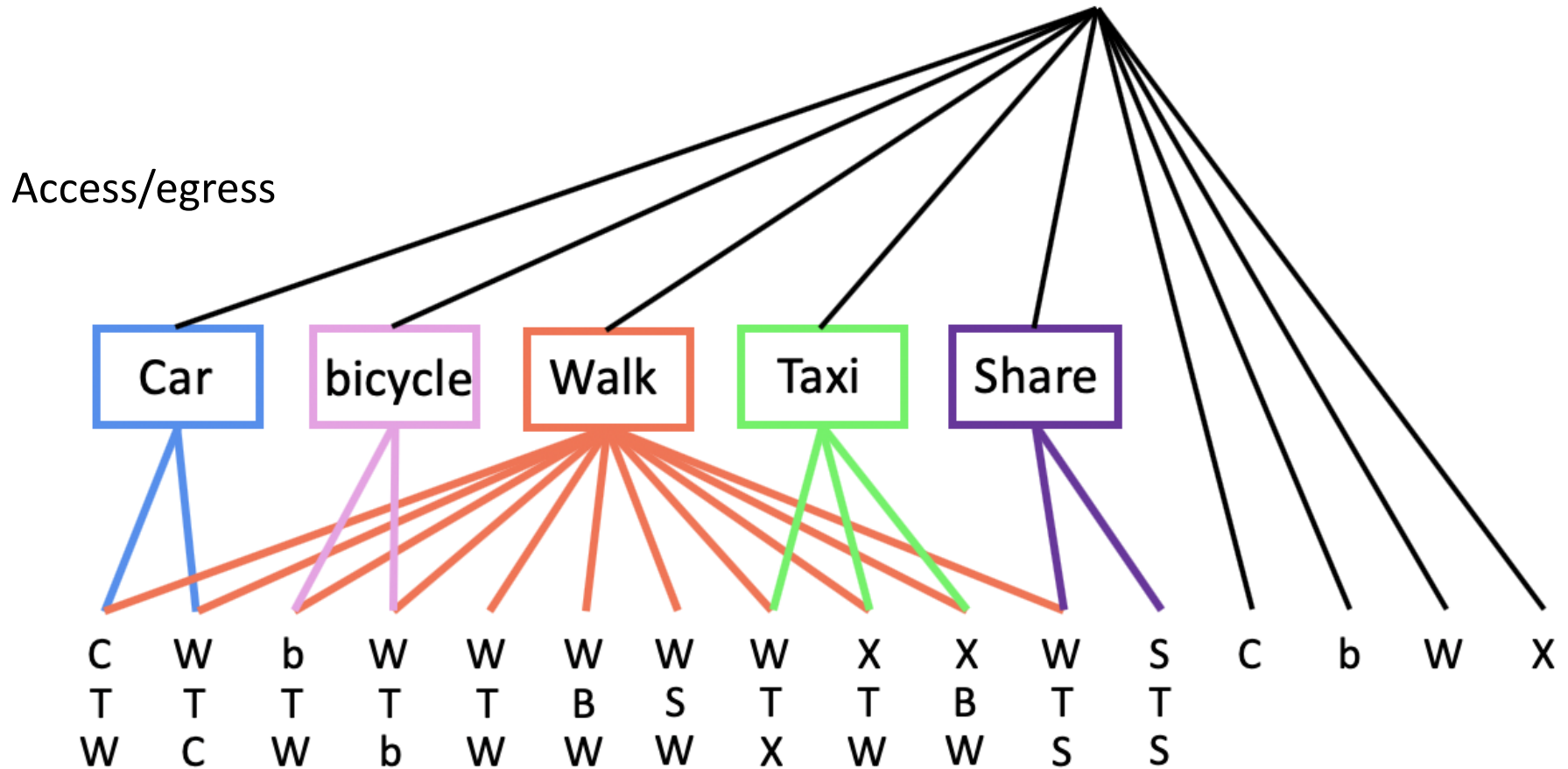$$V_{Share-cycle} = \beta_S + \beta_1 x_{time} + \beta_2 x_{cost}$$

Walk   Bicycle   Car   Taxi   Train   Bus   Share-cycle

Results - MNL

Variables	Parameter	t-value
Constant(Bike)	-0.40	-7.42**
Constant(Car)	-1.34	-19.12**
Constant(Taxi)	-4.21	-23.13**
Constant(Train)	1.10	27.25**
Constant(Bus)	-2.06	-27.32**
Constant(Share cycle)	-2.36	-23.95**
Travel time	-16.94	-25.54**
Cost	-0.04	-1.79
Number of samples	8520	
L(0)	-13530.97	
LL	-6029.86	
Rho-square	0.5544	
Adjusted rho-square	0.5538	

significance *5%   significance **1%

Mode choice model (CNL)

Access/egress

$$V_i = \beta_i + \beta_1 x_{time} + \beta_2 x_{cost} \qquad i: mode$$

C: private car, W: walk, T: train, b: bicycle, B: bus, X: taxi, S: share cycle

Results - CNL

Variables	Parameter	t-value
Constant(CTW)	-4.07	-18.25**
Constant(WTC)	-5.14	-15.63**
Constant(bTW)	-2.81	-17.73**
Constant(WTb)	-2.85	-17.81**
Constant(WTW)	-0.46	-6.47**
Constant(WBW)	-3.54	-20.50**
Constant(WSW)	-3.60	-19.41**
Constant(WTX)	-5.72	-17.91**
Constant(XTW)	-8.05	-10.30**
Constant(XBW)	-8.70	-8.16**
Constant(WTS)	-8.18	-8.29**
Constant(STS)	-8.23	-8.12**
Constant(C)	-2.27	-26.87**
Constant(b)	-2.87	-36.54**
Constant(X)	-4.61	-27.80**
Travel time	-0.04	-23.02**
Cost	-0.18	-7.13**
scale parameter	0.97	17.91**
Number of samples	8520.00	
L(0)	-19272.06	
LL	-7492.98	
Rho-square	0.6112	
Adjusted rho-square	0.6103	

significance *5%   significance **1%

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Policy Analysis

- Originally, "Whim" in Finland was introduced to prompt transition from car use to public transportations.

- See the changes in choice probabilities of public transportations before/after introducing "Whim" service.

	Whim Urban 30 €59,7 / 30 days	Whim Weekend €249 / 30 days	Whim Unlimited €499 / month	Whim to Go Pay as you go
Public transport	HSL 30-day ticket	HSL 30-day ticket	Unlimited HSL single tickets	Pay as you go
City bike	Unlimited	Unlimited	Unlimited	Not included
Taxi (5km)	€10	-15%	Unlimited	Pay as you go
Rental car	€49/day	Weekends	Unlimited	Pay as you go

Changes in choice probabilities

- Users who spent more money for a month than the Mass package price purchase the subscription service.
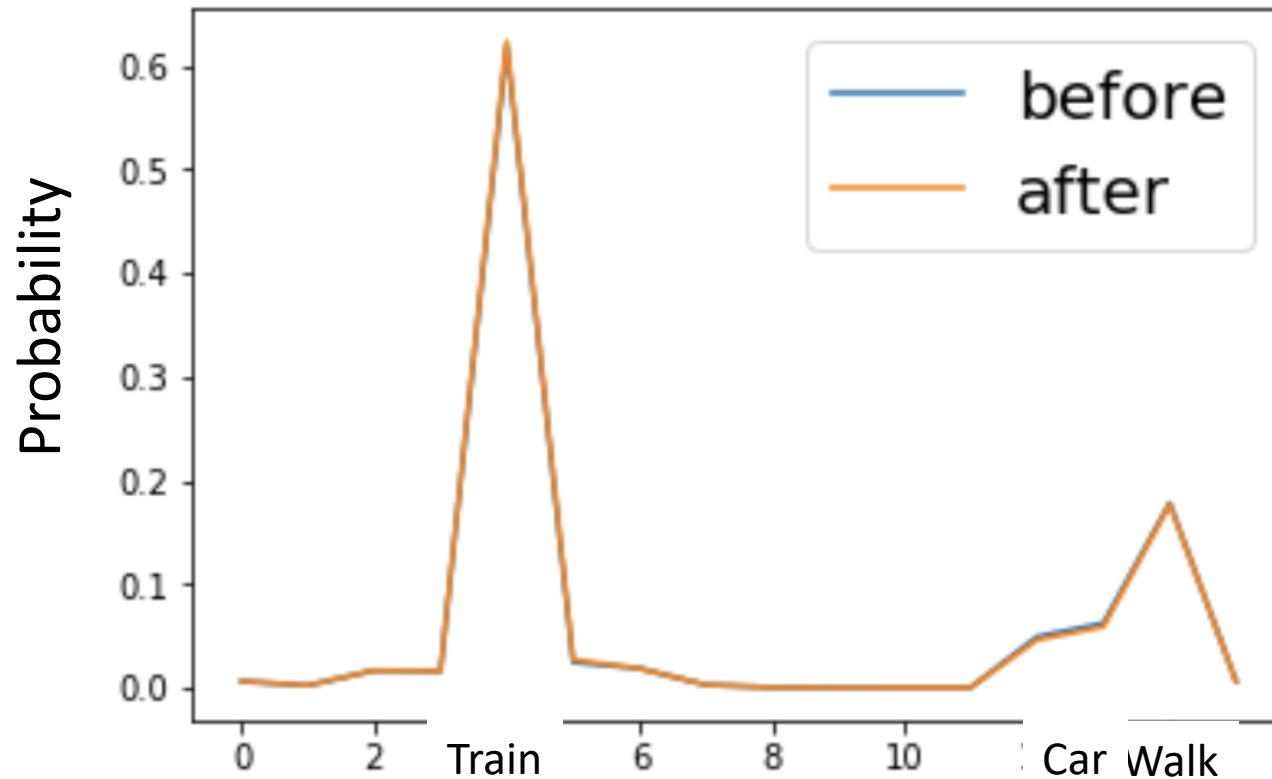
price elasticity is quite low

Summary

- **Model**
  - Likelihood ratio is 0.6103

- **Policy analysis**
  - In "豊洲", most people use trains already and there are a quite few car users (seems that many hold commuter pass).

  - There is almost no differences by introducing Maas.