The 16th Summer School 2017

交通行動における
合理性・非合理性の分析

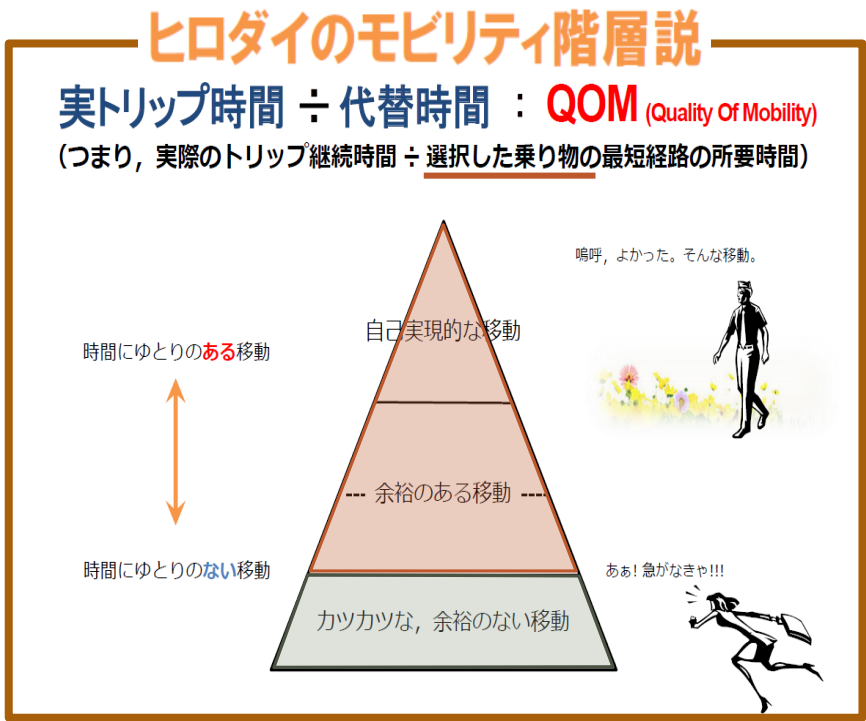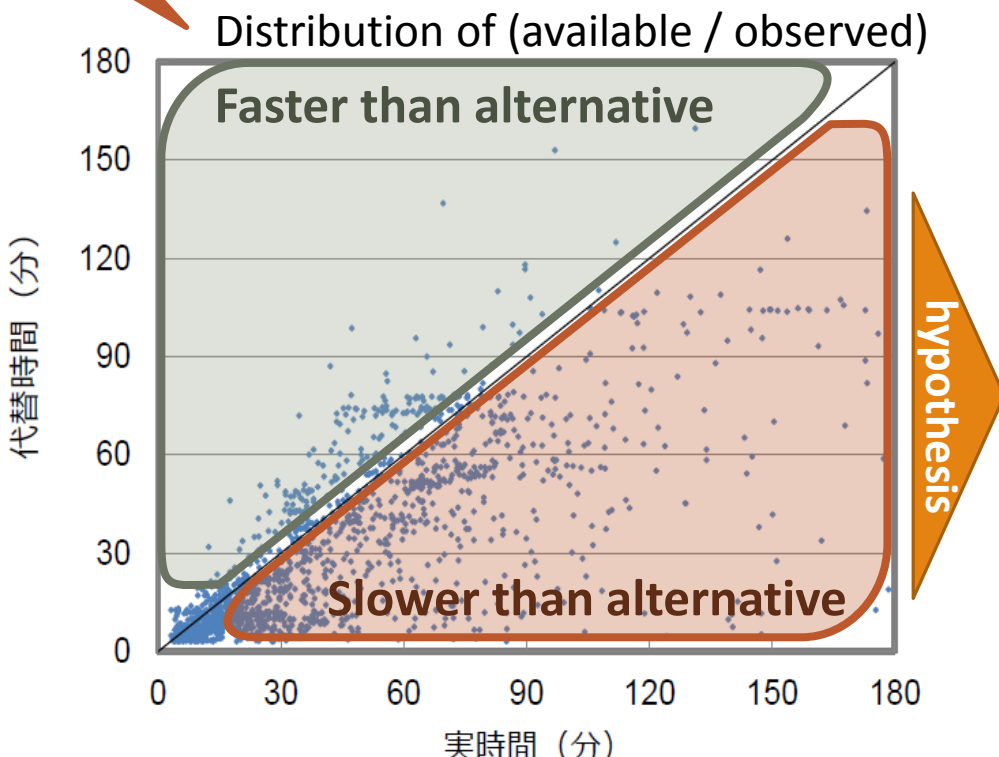## ANALYSIS OF RATIONALITY / IRRATIONALITY IN TRAVEL BEHAVIOR

TEAM M (HIROSHIMA UNIVERSITY)

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Hypothesis of Hiroshima Univ. in 2014

Many travel behavior take twice as much time as alternative time

Distribution of (available / observed)

代替時間（分）

実時間（分）

Faster than alternative

Slower than alternative

hypothesis

ヒロダイのモビリティ階層説

実トリップ時間 ÷ 代替時間 ： QOM (Quality Of Mobility)

（つまり，実際のトリップ継続時間÷選択した乗り物の最短経路の所要時間）

時間にゆとりの**ある**移動

自己実現的な移動

嗚呼，よかった。そんな移動。

--- 余裕のある移動 ---

時間にゆとりの**ない**移動

カツカツな，余裕のない移動

あぁ! 急がなきゃ!!!

Sample size	1522	average	1.93
maximum	28.91	median	1.30
minimum	0.25	Standard deviation	2.21

It takes almost double

2017 Focus Point

2017 Are they choosing a _slower_ travel mode among all alternative?

We focus on Rationality of travel mode choice
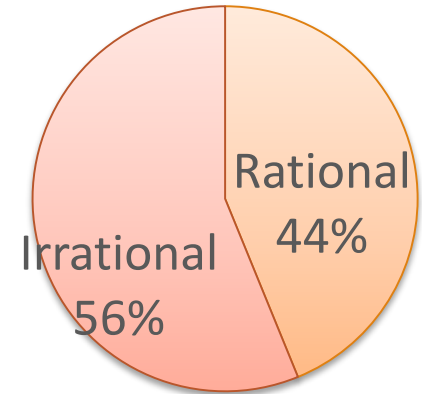
Defining Rationality

rational / irrational
(N=1522)

Rational	selected mode = alternative one takes minimum time
Irrational	selected mode ≠alternative **one takes minimum time**

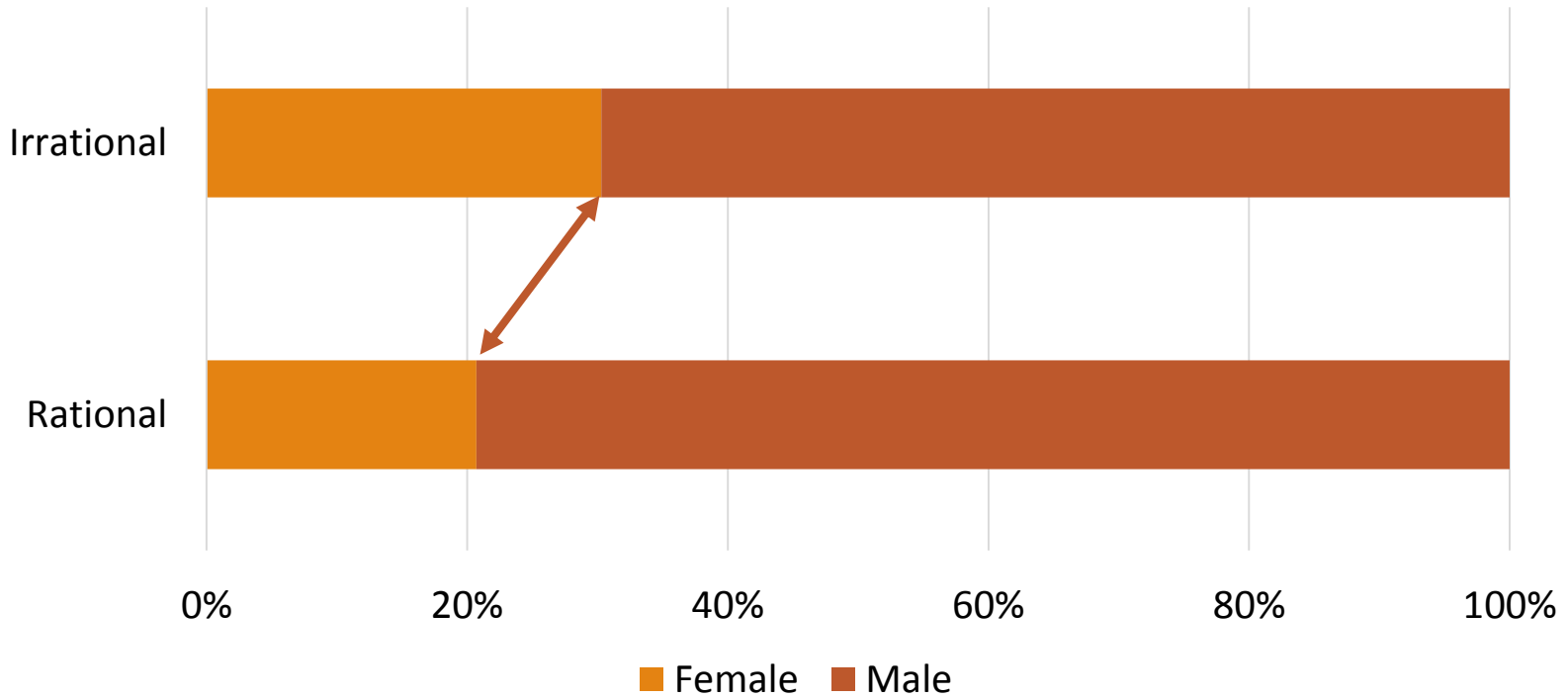In fact, 56% trip didn't behave rational choose of travel mode

① Analyzing the tendency of Rational / Irrational behavior
② Comparing Value of travel time of Rational and Irrational by using estimated parameter
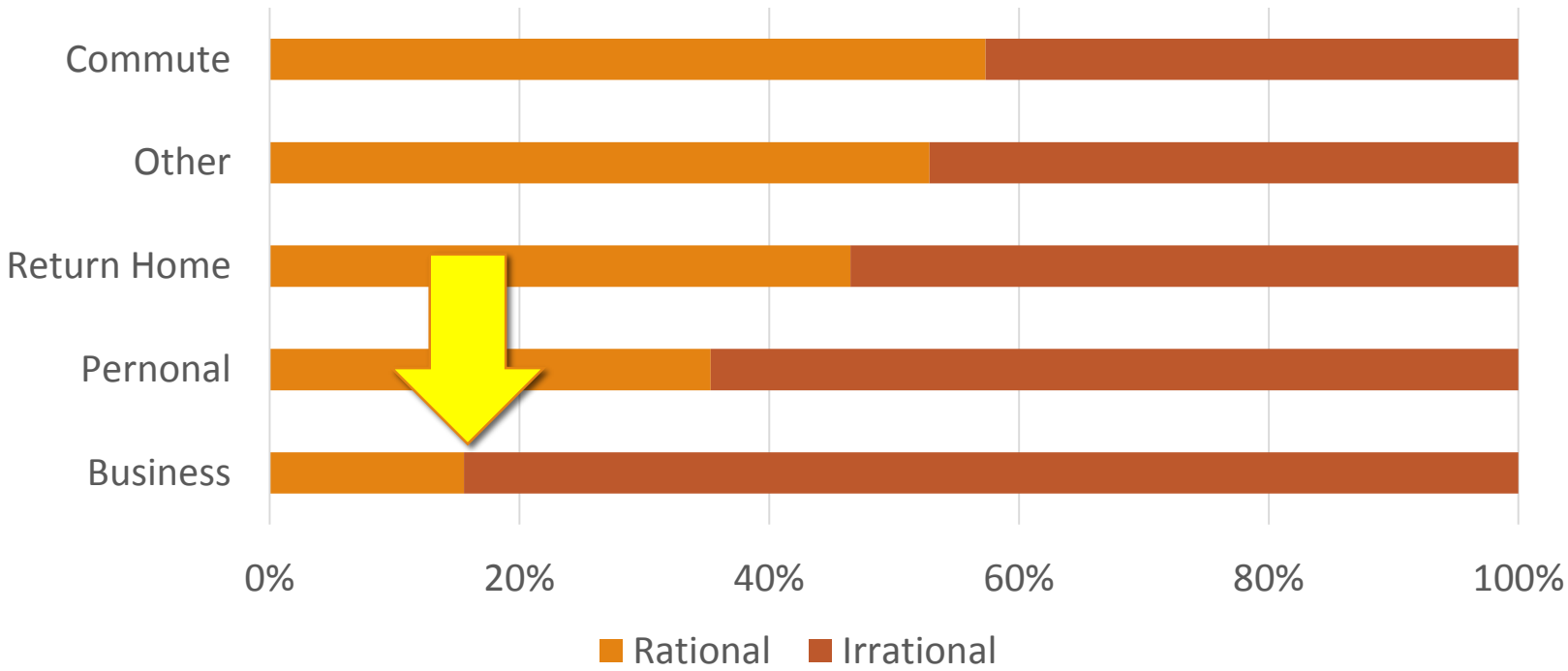
Basic analysis

Rate of the difference acording to sex
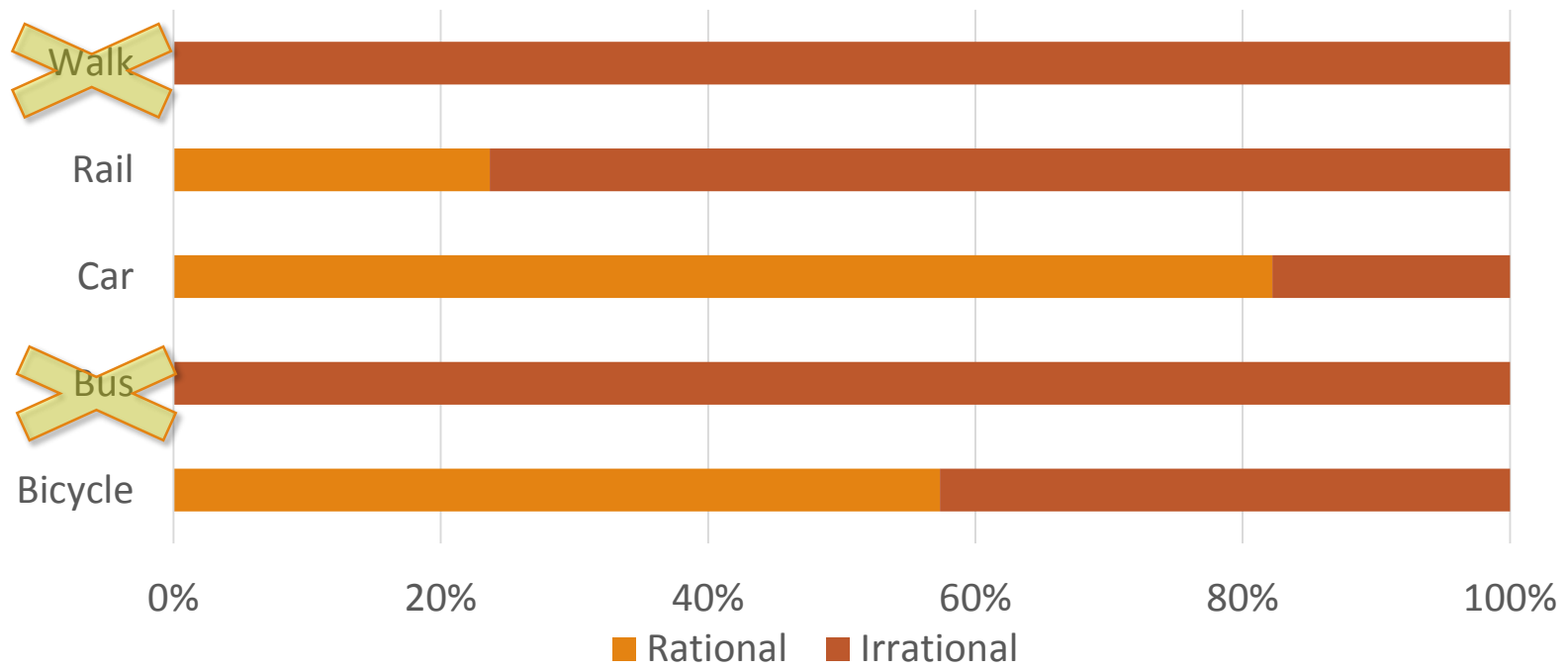

Males prefer to take rational mode

Basic analysis

Rate of the difference acording to puprose

Business trip have tendency to take irrational mode
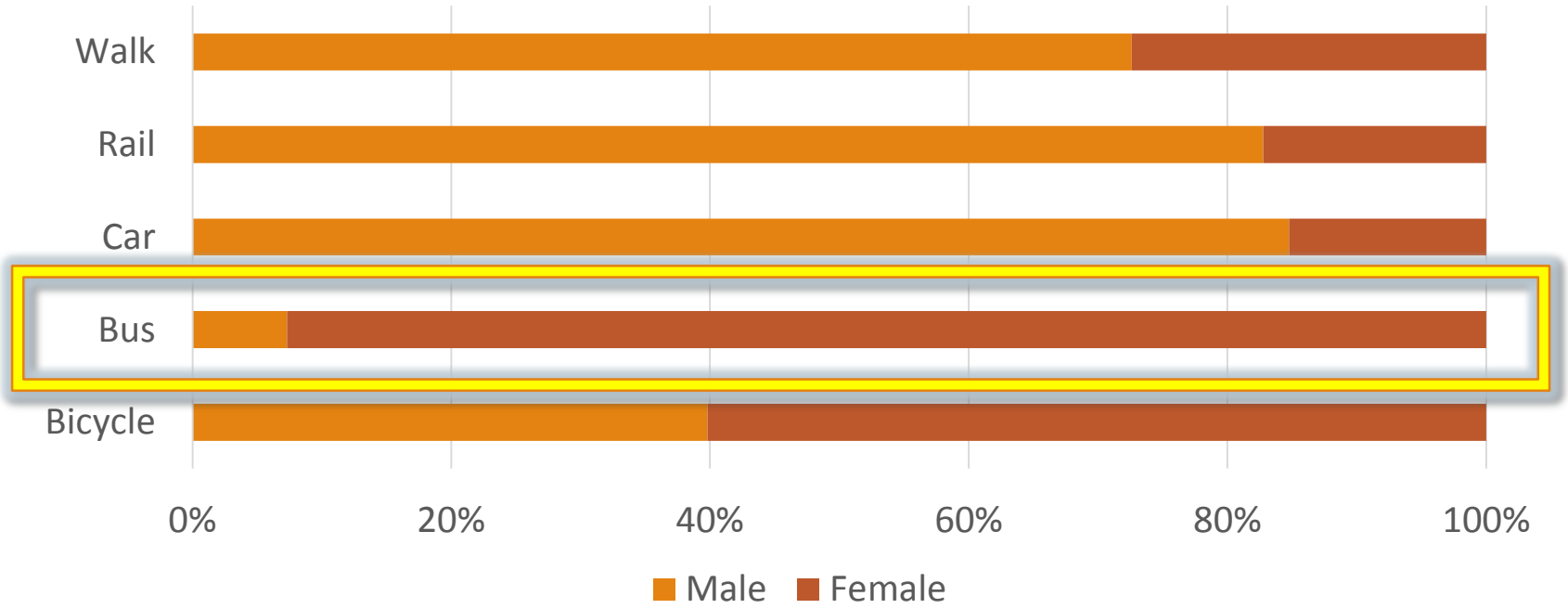
Basic analysis

Rate of the difference according to trip mode

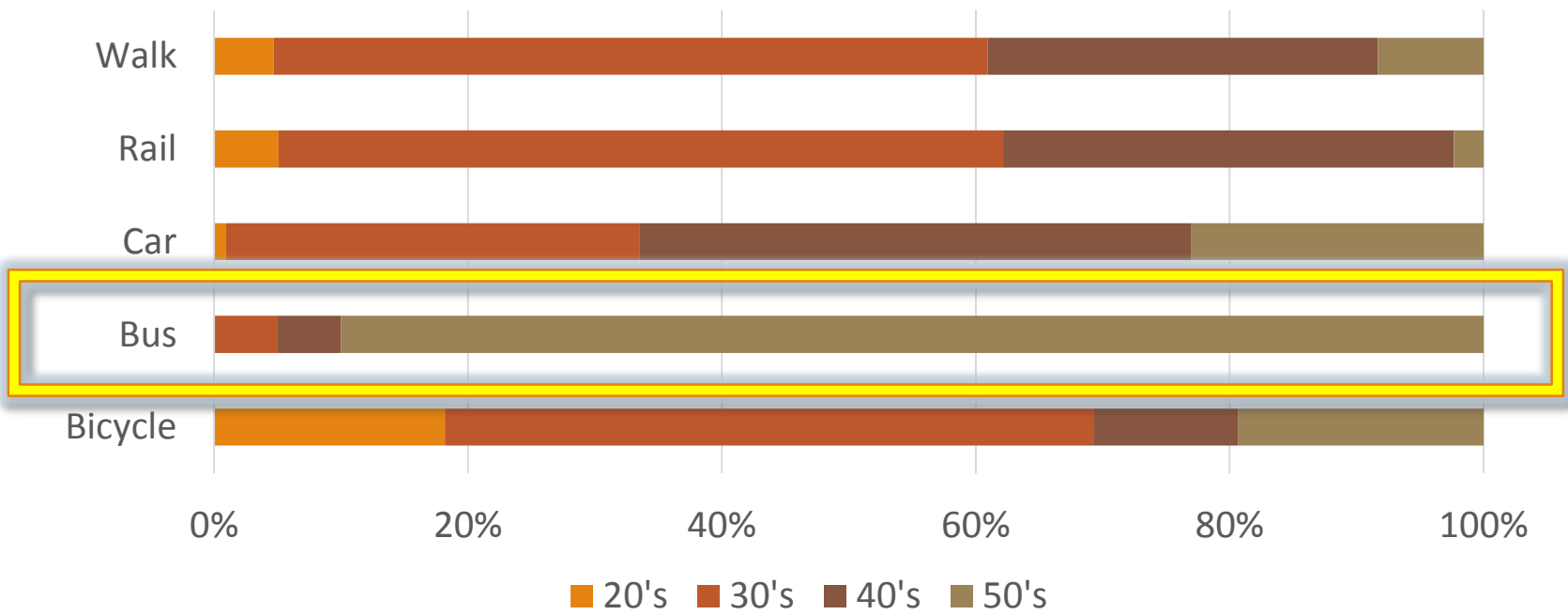Walk and bus are irrational

Basic analysis

Analysis focused on travel mode

Females prefer to take bus

Basic analysis

Analysis focused on travel mode

Many 50's take bus

Binary logit model

$$U_{Rational} = \beta_0 + \beta_1 * time + \beta_2 * cost + \beta_3 * dummy_{sex}$$

$$+ \beta_4 * dummy_{car} + \beta_5 * dummy_{Business} + \varepsilon$$

$$U_{Irrational} = 0$$

$\beta_0 : constant$ $\beta_3 : sex\ dummy$

$\beta_1 : time[min]$ $\beta_4 : car\ dummy$

$\beta_2 : cost[yen]$ $\beta_5 : business\ trip\ dummy$

Model structure

Rational（ observed mode choice ＝ the fastest time）

Irrational（ observed mode choice ≠ the fastest time ）

Estimation Results（Binary Logit Model）

Variable	Parameters	Std. Error	Z value	Pr(z)	
Constant	-1.333	0.128	-10.403	2.2e-16	***
Time [min]	-0.165	0.381	-0.433	0.665	
Cost [yen]	0.127	0.038	3.379	0.000728	***
Dummy [sex]	0.145	0.152	0.953	0.341	
Dummy [car]	2.623	0.142	18.451	2.2e-16	***
Dummy [business]	-0.992	0.271	-3.660	0.000253	***
LL0	-1054.97				
LL1	-777.90				
Rho	0.262				
Rho.adj	0.260				

Multinomial logit model

Utility function（model 2）

$$U_{Train} = \beta_1 + (k * \beta_5 + l * \beta_6) * time_T + (k * \beta_7 + l * \beta_8) * cost_T + \varepsilon_T$$

$$U_{Bus} = \beta_2 + (k * \beta_5 + l * \beta_6) * time_{Bu} + (k * \beta_7 + l * \beta_8) * cost_{Bu}$$
$$+ \beta_9 * dummy_{sex} + \beta_{10} * dummy_{age50} + \varepsilon_{Bu}$$
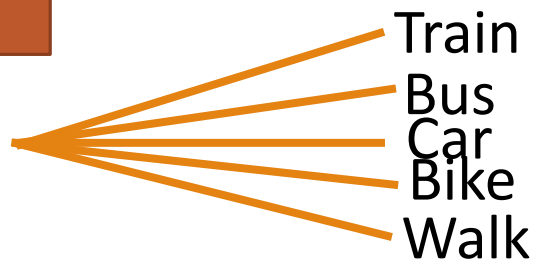
$$U_{Car} = \beta_3 + (k * \beta_5 + l * \beta_6) * time_C + (k * \beta_7 + l * \beta_8) * cost_C + \varepsilon_C$$

$$U_{Bike} = \beta_4 + (k * \beta_5 + l * \beta_6) * time_{Bi} + (k * \beta_7 + l * \beta_8) * cost_{Bi}$$
$$+ \beta_9 * dummy_{sex} + \varepsilon_{Bi}$$

$$U_{Walk} = (k * \beta_5 + l * \beta_6) * time_W + (k * \beta_7 + l * \beta_8) * cost_W + \varepsilon_W$$

β_1: $constant(Train)$
β_2: $constant(Bus)$
β_3: $constant(Car)$

β_4: $constant(Bike)$
β_5: $rational\ dummy$(time)
β_6: $irrational\ dummy$(time)

β_7: $rational\ dummy$(cost)
β_8: $irrational\ dummy$(cost)
β_9: sex dummy
β_{10}: 50s dummy

Model structure

Train
Bus
Car
Bike
Walk

Estimation Results (Multinomial Logit Model)

Variable	Parameters	Std. Error	Z Value	Pr (z)	
Constant(Train)	1.538	0.140	-10.981	2.2e-16	***
Constant(Bus)	9.088	0.576	-15.791	2.2e-16	***
Constant(Car)	1.325	0.113	-11.778	2.2e-16	***
Constant(Bike)	1.830	0.155	-11.810	2.2e-16	***
Dummy[Rational_Time]	9.253	0.577	-16.033	2.2e-16	***
Dummy[Irrational_Time]	2.730	0.354	-7.722	1.146e-14	***
Dummy[Rational_Cost]	0.622	0.068	9.090	2.2e-16	***
Dummy[Irrational_Cost]	0.817	0.058	14.018	2.2e-16	***
Dummy [sex]	2.053	0.174	11.772	2.2e-16	***
Dummy [50's]	4.739	0.541	8.752	2.2e-16	***
LL0	2449.565				
LL1	1365.922				
Rho	0.442				
Rho. adj	0.438				

Policy Simulation