Nested Logit Model of Combined Section for Travel Mode and Departure Time

Team C

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1．1 Data processing

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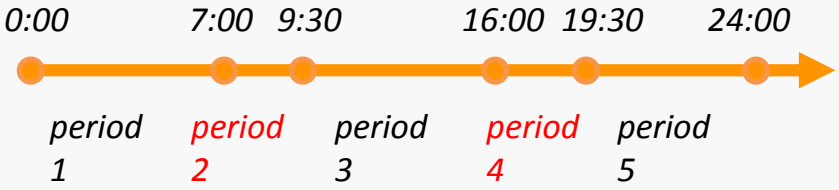
2 more variables



All-day time division

Sun	Mon	Tue	Wen	Thu	Fri	Sat
				29	30	31
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	

20 weekdays + *10* weekends & holidays

1. 2 Basic analysis

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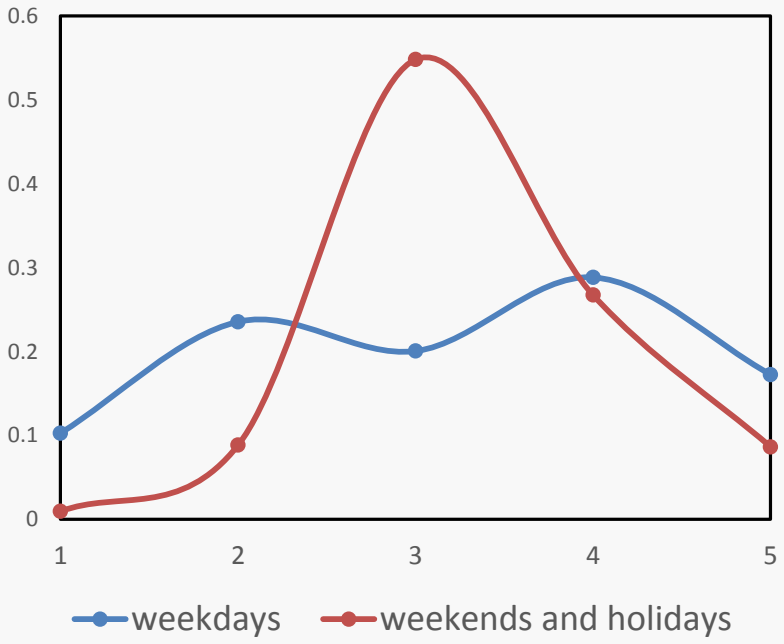
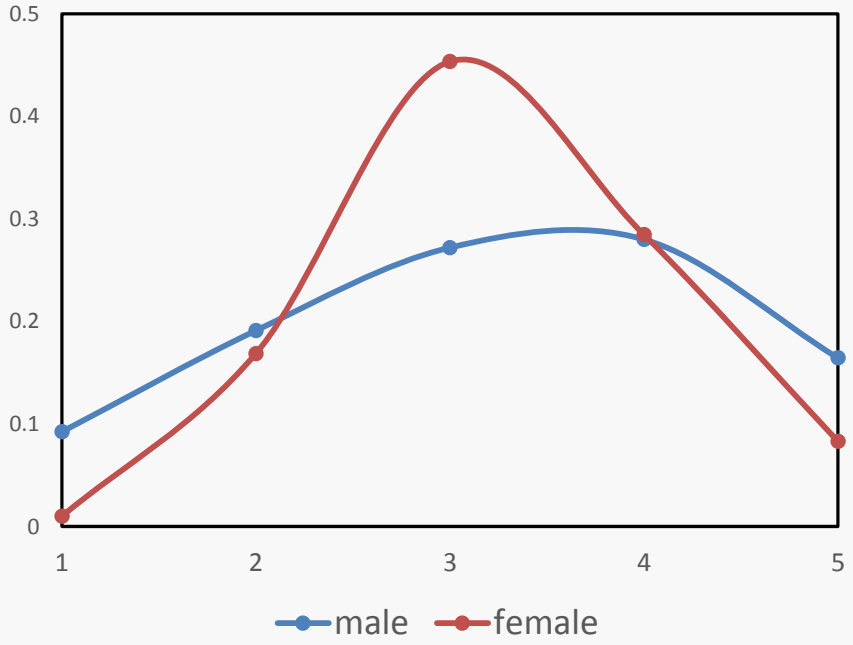
Departure Time Choice Clustering Analysis - 1



Departure Time Choice Clustering Analysis - 2



2. 1 Model Structure

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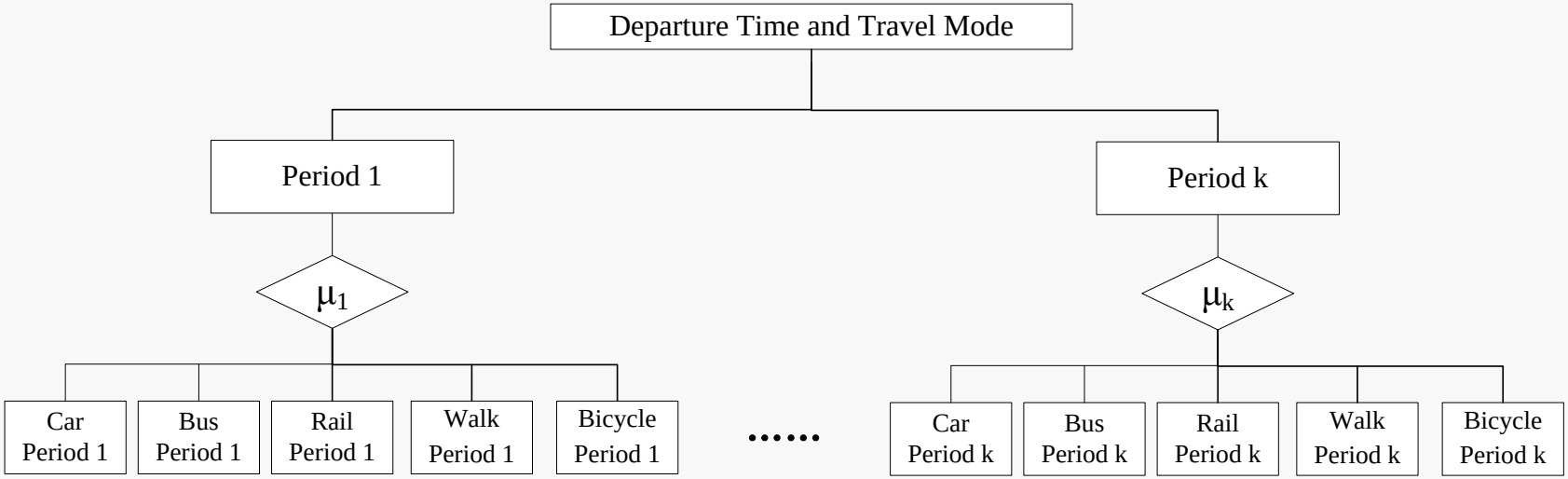

NL model structure with travel mode located in lower layer

2. 2 Utility Function（*NL model*）

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$$V_{T1} = wn1 * x_{weekend} + g1 * x_{female} + \mu_1 \ln\left(\sum_{m \in Mode} \exp\left(V_m / \mu_1\right)\right)$$

$$V_{T2} = wn1 * x_{weekend} + d * x_{ODdistance} + \mu_2 \ln\left(\sum_{m \in Mode} \exp\left(V_m / \mu_2\right)\right)$$

$$V_{T3} = g2 * x_{female} + wn2 * x_{weekend} + \mu_3 \ln\left(\sum_{m \in Mode} \exp\left(V_m / \mu_3\right)\right)$$

$$V_{T4} = d * x_{ODdistance} + sp * x_{weekday} * x_{shopping} + \mu_4 \ln\left(\sum_{m \in Mode} \exp\left(V_m / \mu_4\right)\right)$$

$$V_{T5} = g1 * x_{female} + \mu_5 \ln\left(\sum_{m \in Mode} \exp\left(V_m / \mu_5\right)\right)$$

$x_{weekend}, x_{weekday}, x_{female}, x_{shopping}$

- Dummy variables

$x_{ODdistance}$ *- OD distance(km)*

Mode={walking, bicycle, rail, bus, car}

$$V_{walking} = c_{walking} + t * x_{traveltime}$$

$$V_{bicycle} = c_{bicycle} + t * x_{traveltime}$$

$$V_{rail} = t * x_{traveltime}$$

$$V_{bus} = c_{bus} + t * x_{traveltime}$$

$$V_{car} = c_{car} + t * x_{traveltime}$$

2. 3 Model Estimation

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	Variable	Estimation
Departure time choice	*d(km)*	0.019***
	wn1	-1.2347***
	wn2	1.2657***
	g1	-1.1341***
	g2	0.7908***
	sp	1.5602***
Travel mode choice	*t(h)*	-0.8748***
	Cwalking	0.2774***
	Cbicycle	-0.0832
	Cbus	-1.8644***
	Ccar	0.1538***

Variable	Estimation
μ1	0.2064***
μ2	0.5326
μ3	0(*base*)
μ4	0.5134
μ5	0.3564*
Sample size	1522
Rho-squared	0.221
Ajusted Rho-squared	0.223

Significance level *** - 99.9% ** - 99% * - 95% . - 90%

3. 1 Conclusions

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Departure time and travel mode

- The substitutability between different travel modes exists when decision makers decide to depart in period 1 and 5 as the estimation results of μ1 and μ5 are significant .
- The sign of OD distance in the utility functions of period 2 and 4 are positive.
- Women have more obvious preferences when making departure time choices based on the parameter signs of female dummies.

3. 2 Policy Implications

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Shopping behavior in evening peak hours (based on the findings of the relationship between departure time choice and travel mode choice, and between departure time choice and travel purpose)

- Discount in restaurant and supermarket could start from 8 pm. This may make some commuters to change their schedules, such as delaying their leaving time from work.

Women-only passenger car (based on the finding of departure time choice and gender)

- It is possible to adjust the number of WOPC according to women preferences.

Thank you !