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Travel Behaviour Case Study: Connecting the airport with the city

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Presentation outline

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Background Information

Air Passenger Transport Demand

- has been tremendously increased worldwide, over the last 40 years
- until 2001, had shown growth rates twice as great as world economic growth
- was increased in the last decade, due to
 - growing penetration of low cost airlines
 - internet spreading
 - smartphone applications
 - need for more long trip mobility
- airport passenger demand growth -> redesign of airport capacity in terms of runways, terminals, transport access infrastructure

Airport Transport Access Infrastructure (1/2)

- In 2006, almost 40% of the 150 busiest airports in the world had a rail link connection
- 12% were at an advanced stage of planning or constructing a rail link (OECD, 2008)
- rail link connection: the majority of European large airports, fewer cases are observed for the US
- a fixed track system can attract over 40% of the airport visitors
- airports without rail-link connections could not achieve public transport shares greater than 30% (Ashley & Merz, 2002)

Airport Transport Access Infrastructure (2/2)

- investment postulate high funding resources
- business risk of introducing a new airport link mode should be minimized
- In depth analysis of the parameters affecting the demand of the new mode should be performed.

Mode Specific Parameters

Travel time, travel cost, number of transfers

User Specific Parameters

gender, age, income, vehicle ownership, trip purpose, luggage handling

The Airport under examination

- Thessaloniki International Airport “Macedonia” (IATA code: SKG, ICAO code: LGTS)
- operates since 1930
- second largest state owned airport in Greece
- located in the SE suburban area of the city of Thessaloniki (16 km from the city center)
- a key player for the development of Northern Greece
- serves annually over 4 million passengers (60% international passengers). (HCCA, 2013)
- fully renovated prior to the commencement of the Athens 2004 Olympic Games

Airport Transport Access Facts

- located nearby the sea, its access through surface modes is limited
- accessible only by car, public transport (buses) and taxi.
- 2,300 parking spots are provided
- only one bus line runs every 30 min (winter time)
- actual modal split estimation (THEPTA,2011)
 - Car 54.5%
 - Bus 18.5%
 - Taxi 27.0%

Undertaken Activities

Airport Future Challenges

- Airport master plan to serve 8 mio passengers
- City's transport plan anticipates a 5.1 km length connection with the metro terminal



FIGURE 1: The connection of the airport with the metro terminal station “MIKRA”

Undertaken Activities

Airport Future Challenges

- 3 alternative air link modes were considered
 - Metro (extension line)
 - Tram
 - Monorail
- Feasibility study was conducted within CIVITAS-CATALYST project (THEPTA, 2011)
- An advantage to the monorail option was documented
- RP&SP survey was conducted to
 - Car users
 - Bus users
 - Taxi users

Undertaken Activities

Questionnaire Survey

- **Section 1:** Trip Characteristics of responder mode used to travel to the airport, travel frequency, estimated trip cost and time to the airport, trip purpose, origin point and/or final destination
- **Section 2:** Stated Preference Experiment
Hypothetical scenarios about the examined fix-track systems (factorial design with 9 choice sets)
- **Section 3:** interviewees' socio-economic characteristics.

Undertaken Activities

Stated Preference Experiment

	Metro	Tram	Monorail
Car Users			
Travel Time	(-10, 0, +10)	(-10, 0, +10)	(-10, 0, +10)
Cost	(-5, -3, -1)	(-1, -5, -3)	(-3, -1, -5)
Transfers	(0, 2, 1)	(2, 1, 0)	(1, 0, 2)
Bus Users			
Travel Time	(0, -10, -20)	(0, -10, -20)	(0, -10, -20)
Cost	(+1, +2, +3)	(+3, +1, +2)	(+2, +3, +1)
Transfers	(0, 2, 1)	(2, 1, 0)	(1, 0, 2)
Taxi Users			
Travel Time	(-10, 0, +10)	(-10, 0, +10)	(-10, 0, +10)
Cost	(-5, -15, -10)	(-10, -20, -15)	(-15, -10, -20)
Transfers	(0, 2, 1)	(2, 1, 0)	(1, 0, 2)

Table 1 Attribute Levels for the SP Experiment

Undertaken Activities

Questionnaire Survey

- Conducted within 1 month period (March to April)
- For the development of the choice models, 357 responses were finally considered as valid
- Binary choice models were developed between
 - The existing mode (car/bus/taxi)
 - The alternative given (metro/monorail/tram)
 - To identify how (and in which extent) **mode** and **user** specific attributes are affecting mode choice procedure
 - 18 binary choice models developed
 - 3 demand segments x 3 alternatives x 2 models = 18

Descriptive Statistics

Variable/interval		Car Users (N=126)		Bus Users (N=105)		Taxi Users (N=126)	
		Freq.	%	Freq.	%	Freq.	%
Frequency	Every Day	58	46.0	20	19.0	0	.0
	> 4 times/month	1	.8	2	1.9	0	.0
	4 times/month	1	.8	2	1.9	2	1.6
	3 times/month	3	2.4	1	1.0	5	4.0
	2 times/month	4	3.2	2	1.9	11	8.7
	1 time/month	12	9.5	10	9.5	13	10.3
	Seldom*	47	37.3	68	64.8	95	75.4
Purpose	Work	58	46.0	20	19.0	0	0
	Fly*	18	14.3	69	65.7	116	92.1
	Escort	50	39.7	16	15.2	10	7.9
gender	Man*	72	57.1	42	40.0	68	54.0
	Woman	54	42.9	63	60.0	58	46.0
age	18-25*	15	11.9	46	43.8	24	19.0
	26-35	39	31.0	32	30.5	32	25.4
	36-45	37	29.4	8	7.6	31	24.6
	46-55	26	20.6	14	13.3	25	19.8
	56-65	7	5.6	1	1.0	13	10.3
	66+	2	1.6	4	3.8	1	.8
occupation	Private Employee	76	60.3	35	33.3	39	31.0
	Public Employee	14	11.1	16	15.2	12	9.5
	Free Lancer	24	19.0	14	13.3	36	28.6
	Student	4	3.2	32	30.5	19	15.1
	Retired	4	3.2	5	4.8	11	8.7
	Unemployed	4	3.2	3	2.9	9	7.1
PuT pass	yes	4	3.2	19	18.1	3	2.4
	no	122	96.8	86	81.9	123	97.6

Modal Choice Specification

Model 1			
Vmetro		Vcar	
beta	Parameter	beta	Parameter
β_1	metro _{time}	β_4	car _{time}
β_2	metro _{cost}	β_5	car _{cost}
β_3	metro _{transfers}	β_6	car _{transfers}
			ASC _{car}
Model 2			
Vmetro		Vcar	
beta	Parameter	beta	Parameter
β_1	metro _{time}	β_4	car _{time}
β_2	metro _{cost}	β_5	car _{cost}
β_3	metro _{transfers}	β_6	car _{transfers}
		β_7	freq_everyday
		β_8	freq>4times_month
		β_9	freq_4times_month
		β_{10}	freq_3times_month
		β_{11}	freq_2times_month
		β_{12}	freq_1times_month
		β_{13}	purp_work
		β_{14}	purp_accomp
		β_{15}	Age_26-35
		β_{16}	Age_36-45
		β_{17}	Age_46-55
		β_{18}	Age_56-65
		β_{19}	Age_plus
		β_{20}	gender
			ASC _{car}

- The only models with statistical significant *alternative specific constant (ASC)*
- negative ASC for the car, meaning a relative preference of the car users for the alternative (strong preference to the metro system, followed by the tram and the monorail respectively)
- **Mode Specific Variables**
 - Travel Time (for the metro and monorail model)
 - Number of Transfers (metro and monorail model)
 - Travel cost (tram model)
- **User Specific Variables**
 - Age (metro and tram model)
 - Trip frequency (monorail model)

Car Users Modal Behavior Results (2/2)

- Standardized Estimates

 - Travel time almost twice as important compared to the number of transfers (for the metro and monorail model)

 - User specific variables have lower effect compared to mode specific variables

- Likelihood Ratio tests indicate **zero effect** on mode choice interpretation, regarding the car users, since they do not improve the explanatory power of the choice models with the only exception of the tram model (sig 95% level)

- ❑ No statistically significant *alternative specific constant (ASC)*
- ❑ In line with the findings of similar studies that argue about the relative preference of existing public transport users over the alternative proposed rail public transport mode (Axhausen et al, 2001, Ben-Akiva & Morikawa, 2002, Scherer, 2010)
- **Mode Specific Variables**
 - Travel Time and Cost (all models)
 - Number of Transfers **NOT**
- **User Specific Variables**
 - Gender (all models)
 - Trip frequency (metro and monorail models)
 - Age (tram model)

- Standardized Estimates

 - Travel time is the dominant factor for mode choice

 - User specific variables have also strong influence in mode choice

- Likelihood Ratio tests indicate **strong effect** on mode choice interpretation, regarding the bus users, since they do improve the explanatory power of the choice models (sig.99% for all models)

- No statistically significant *alternative specific constant (ASC)*
- in line with the findings of similar studies (Castillo-Manzano, 2010, Jou et al, 2011, Roh, 2013)
- **Mode Specific Variables**
 - Travel Time (metro model)
 - Travel Cost (all models)
 - Number of Transfers (all models)
- **User Specific Variables**
 - Age (all models)
 - Gender (monorail model)
 - Trip purpose (monorail and tram models)
 - Frequency (monorail and tram models)

- Standardized Estimates
 - Travel cost and transfers the dominant factors for mode choice
 - User specific variables also influence mode choice
- Likelihood Ratio tests indicate **strong effect** on mode choice interpretation, regarding the taxi users, since they do improve the explanatory power of the choice models (sig.99% for all models)

Odds Ratio Calculations

Beta	Variables and reference variables	Car Users			Bus Users			Taxi Users		
		M1	MR	T	M1	MR	T	M1	MR	T
Age: Reference category 18-24 years old										
b15	Aged 26 to 35 years old							4.6	2.8	9.0
b17	Aged 46 to 55 years old	1.7		1.8				5.4	4.0	4.7
b19	Aged over 66 years old						0.1		35.2	17.6
Frequency: Reference category travel seldom										
b7	every day				3.0					
b9	travel 4 times per month								35.2	17.6
b11	travel 2 times per month		3.5							2.3
b12	travel 1 time per month				0.2	0.4				
Gender: Reference category man										
b20	Woman				2.4	2.4	3.1		2.3	
Purpose: Reference category fly										
b14	Escort								0.2	0.3

Travel Cost and Time Elasticities

Current mode	Metro		Monorail		Tram	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Travel Time Elasticities						
Car	+0.281	+0.279	+0.018	+0.019	+0.002	+0.002
Bus	+0.260	-	+0.242	+0.282	+0.487	+0.532
Taxi	-	-	-	-	-	-
Travel Cost Elasticities						
Car	-	-	-	-	-	-
Bus	+0.449	-	+0.374	+0.320	+0.422	+0.312
Taxi	+15.773	+14.951	+3.059	+2.855	+0.829	+1.161

Final Conclusions

- airport ground access modes plays among other factors an important role in the attractiveness of an airport
- The analysis confirmed previous findings
time, cost and number of transfers in the mode choice
user specific variables (socioeconomic and trip characteristics) seems to play an important role in the mode choice process in the case of the **bus users** and the **taxi users**.

Important determinants : traveler's age, gender and the frequency travel to the airport

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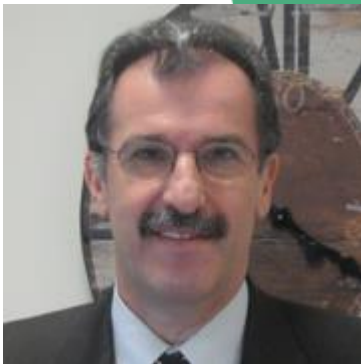
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Thank you!



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Questions welcome



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