

II EUROPEAN CONFERENCE ON SUSTAINABLE MOBILITY AT UNIVERSITIES
KRAKOW UNIVERSITY OF TECHNOLOGY



TRANSPORT MODE CHOICE AND COMMUTING TO UNIVERSITY: A MULTINOMIAL APPROACH

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OUTLINE OF THE PRESENTATION



- Background and research context
- Research questions
- Literature review
- Methodology
- Results and discussion
- Conclusions and policy implications

BACKGROUND

- Universities are fundamental cultural and socio-economic poles but also nodes which generate and attract high level of traffic (Rodriguez and Joo, 2004; Lovejoy and Handy, 2011; Delmelle and Delmelle, 2012).
- Commuting to school (including university) tends often to be based on a car-dominant transport system
- Sustainable commuting policies → to stimulate collective modal alternatives with a low environmental impact (Zhou, 2012)

UNIVERSITY COMMUTING HABITS: SELECTED PAPERS



Authors	Aims and methods	Results
Zhou (2012)	This paper studies university students (UCLA, Los Angeles, 2010 data) in the commuting and housing process in a predominant car context	<ul style="list-style-type: none"> Discounted transit pass increase the odds of alternative modes. Parking permits reduce them. Commute distance is positively related to car-pooling. Gender and age are correlated to public transit. Having classmates living nearby increases the odds of taking public transit.
Zhou (2017)	1661 survey responses by students of ISU (USA); April 2012 using Multinomial Logit Model	Commuting students in college towns have higher share of biking and walking to university than urban university students. But carpooling is more popular among students of urban universities. Short commute time increases odds of biking and walking. Considering gender, male students are more likely to bike to school.
Whalen et al. (2013)	Survey at the McMaster University (Hamilton, Canada) to identify the mode choice determinants. Econometric analysis (MNL and nested Logit)	Modal choices are influenced by a mixture of cost, individual attitudes, and environmental factors.

UNIVERSITY COMMUTING HABITS: SELECTED PAPERS



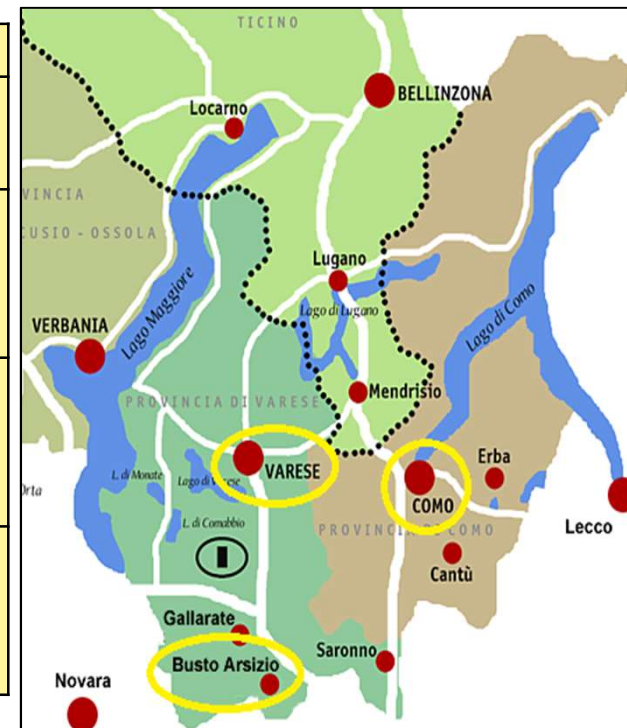
Authors	Aims and methods	Results
Danielis et al. (2016)	Estimation of the potential demand for car sharing by University of Trieste (Italy) users	The influence of psychological cost\benefit elements on the commuter's needs and behavior is underlined
Wang and Liu (2015)	Two different surveys (2013 and 2014) with an amount of 11061 responses by students of university of Queensland (Australia); Models used: Multiple regression models	Travel time and distance are the most influential predictors of public transport use. In fact, public transport is more popular for medium/long distance commuters; students are more vulnerable than staff to the increase of public transport fare.
Nguyen-Phuoc, Amoh-Gyimah, Tran, & Phan (2018)	503 survey responses by students of six universities in Danang (Vietnam) using Conditional Logit Model	Age, gender and income have a significant impact on mode choice. Home-school travel time have a strongly negative impact on walking. Students who are using motorcycles are willing to switch to public transport if an efficient system is available

RESEARCH CONTEXT

UNINSUBRIA IN A NUTSHELL

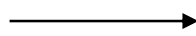
- University of Insubria (Uninsubria) is an Italian public university founded in 1998.
- It is placed in the North-Western part of Italy and it has two main poles, Varese and Como, which attract a growing number of students. The third minor site is in Busto Arsizio (Varese).

Role	Busto A.	Como	Varese	Total
Student	59	2661	7787	10507
T.A. Staff	6	91	223	320
Professors	12	264	217	493
Total	77	3016	8227	11320



RESEARCH QUESTIONS

RQ1: Does the alleged car-dominance in commuting habits apply for Uninsubria poles?



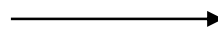
Descriptive statistics

RQ2: What are the main drivers of modal choice to/from the different Uninsubria poles?



Econometric analysis (MNL)

RQ3: how commuters who travel to different poles (Varese, Como) evaluate public transport services and what can motivate a propensity to change?



Descriptive statistics and pairwise t-tests

METHODOLOGY

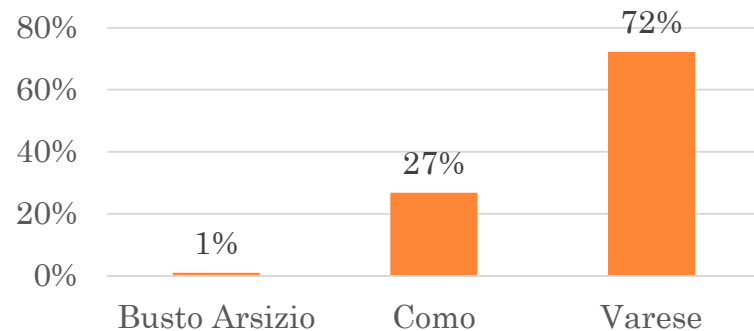
UNINSUBRIA MOBILITY SURVEY

- On-line survey (November 2017): all the university users (students, professors, technical/administrative staff) for each site (Varese, Como and Busto Arsizio)
- Structure of the questionnaire:
 - Socio-demographic data (age, gender, education, role, residence, etc.)
 - Commuting-related data (distance, frequency, costs, destination, number of means used, etc.)
 - Information related to car pooling/sharing attitude, bike sharing and green sustainability attitudes
 - Evaluation of existing/prospective policy measures (e.g., shuttle bus)

UNINSUBRIA MOBILITY SURVEY: SAMPLE DATA

	Varese		Como		Busto Arsizio		Total	
Role	Pop.	Respondents	Pop.	Respondents	Pop.	Respondents	Pop.	Respondents
Students	7787	1690 (21,7%)	2661	622 (23,3%)	59	15 (25,4%)	10507	2327 (22,1%)
Faculty	217	151 (69,6%)	264	60 (23,1%)	12	8 (66,7%)	493	219 (44,6%)
Staff	223	147 (65,9%)	91	58 (63,7%)	6	4 (66,7%)	320	209 (65,3%)
Total	8227	1988 (24,1%)	3016	740 (24,5%)	77	27 (35,1%)	11320	2755 (24,3%)

Final destination of the sample



► Due to little information we have excluded from the econometric analysis the observations on Busto Arsizio (only descriptive statistics).

SAMPLE CHARACTERISTICS: VARESE

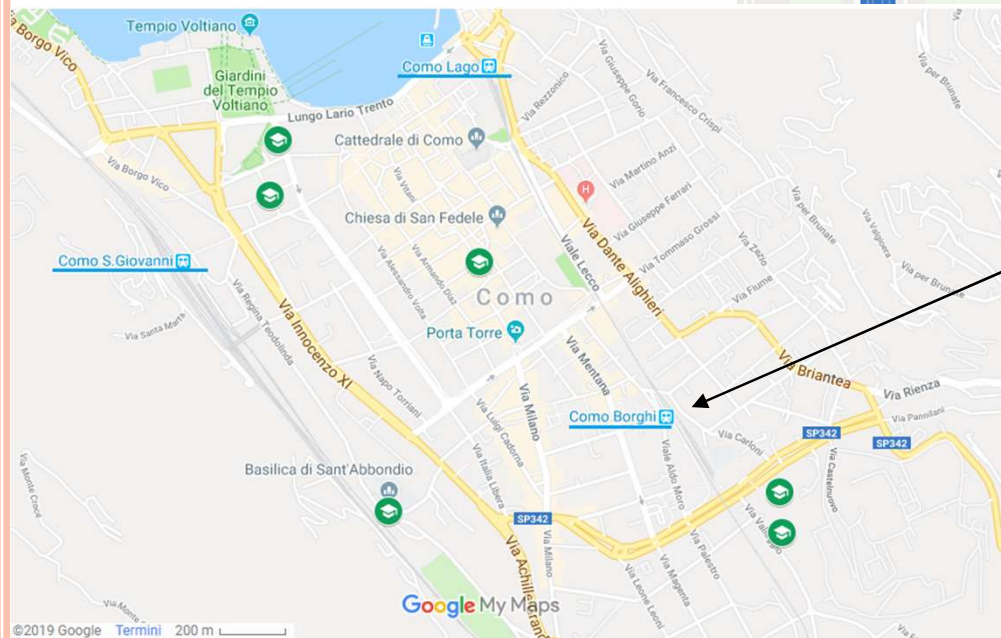
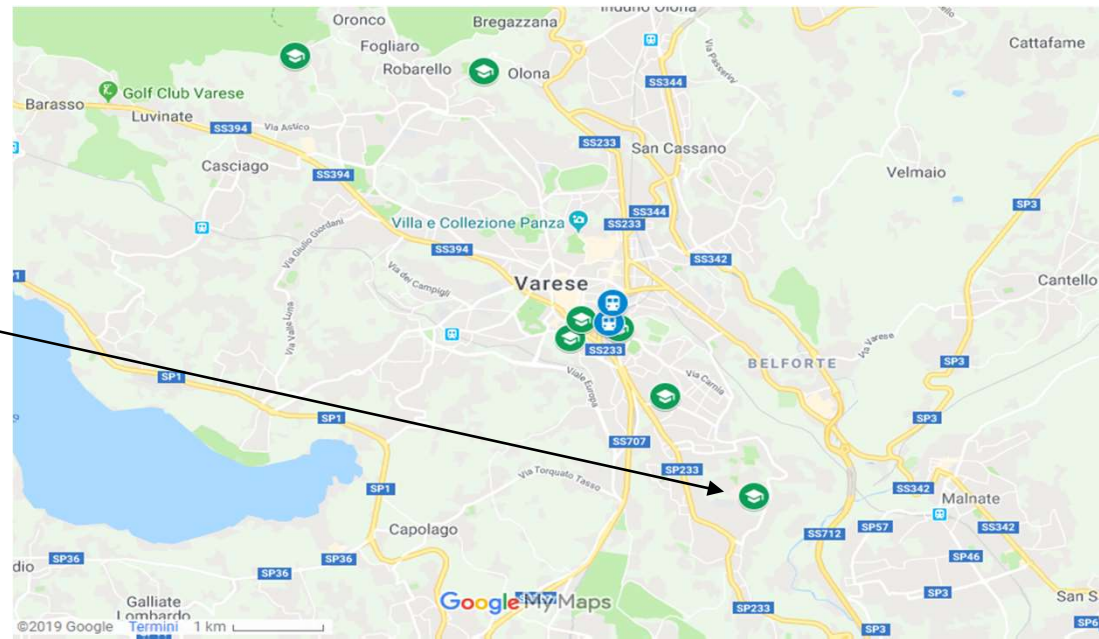
	Students	Professors	T.A. Staff
Age	23,76	51,5	47,09
Gender	M (58%)	F (56.29%)	M (74%)
Day per Week	3,9	3,6	4,7
Principal Means of T.	Car/Motorbike (63.36%)	Car/Motorbike (76.82%)	Car/Motorbike (78.38%)
Number of Means	1,55	1,32	1,12
Duration of the Trip(min.)	46	46	32
Distance	28 km	40 km	17 km
Monthly cost for transport	€ 68	€ 78,45	€ 64,36
Incidence of transport costs on Income(%)	No Income(57.8%)	Less than 5% (46.3%)	Between 5% and 10% (35%)

SAMPLE CHARACTERISTICS: COMO

	Students	Professors	T.A. Staff
Age	23,49	50	45,63
Gender	M (69%)	F (60.32%)	M (62%)
Day per Week	4.1	3.5	4.98
Principal Means of T.	Rail (34.67%)	Rail (46%)	Car/Motorbike (77.6%)
Number of Means	1,65	1,57	1
Duration of the Trip(min.)	47	52	29
Distance	24,5 km	52 km	12 km
Monthly cost for transport	€ 68,82	€ 77,51	€ 58,63
Incidence of transport costs on Income(%)	No Income (54.4%)	Less then 5% (55.5%)	N.A. (34.5%)

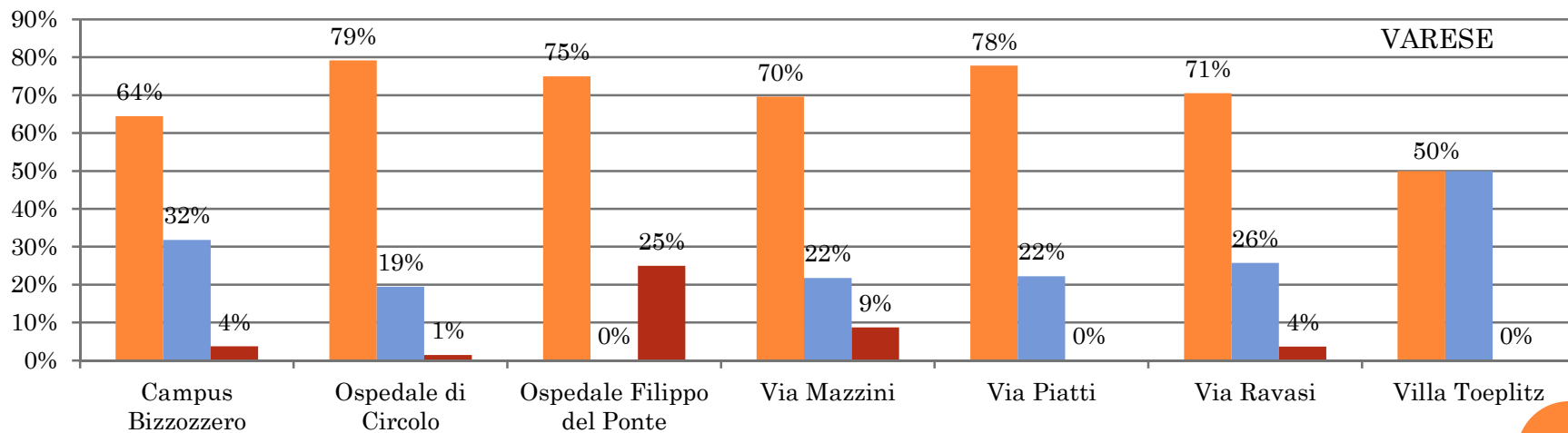
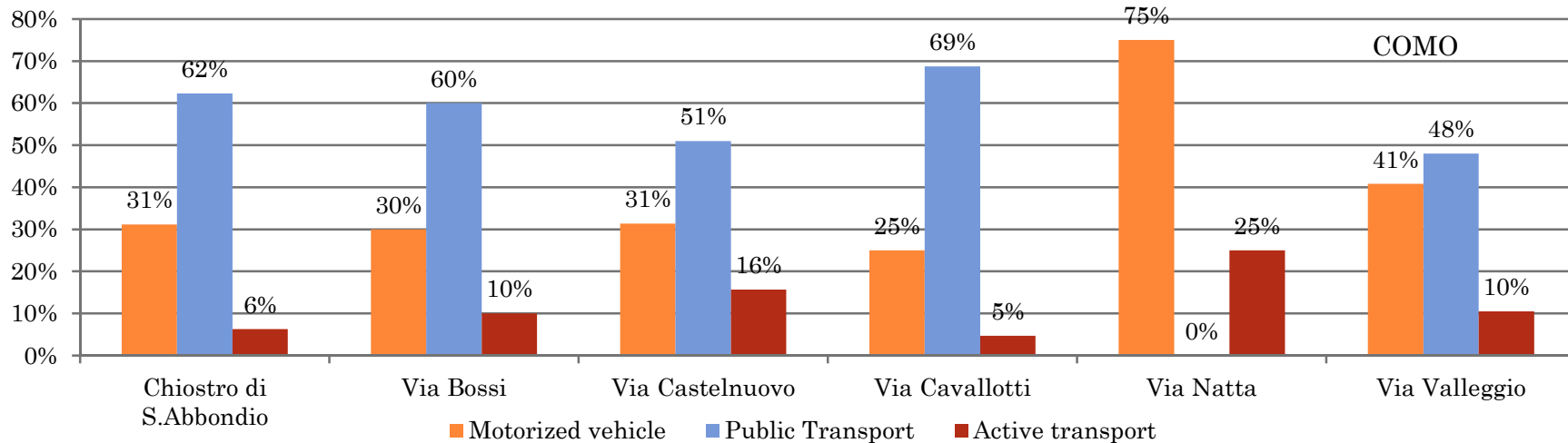
UNINSUBRIA: A TALE OF TWO POLES?

In Varese the main site (Bizzozzero) is far from the city center with a lack of local public connection. Moreover, in that area, it is available free car parking spaces.



In Como there are relevant parking problems, but the sites are located in the center of the city. All of them could be easily reached by bus or railway.

MODAL SHARE AND CAR-DOMINANCE: DIFFERENCES BETWEEN POLES



METHODOLOGY

ECONOMETRIC APPROACH

Multinomial Logit (MNL)

- The MNL model is used to investigate the commuting mode choice of Uninsubria users
 - Travel habits (dependent variable) grouped into three modes with different environmental impact: Rail (train); Road_C (urban bus, extra-urban bus); Road_S (car, motorbike)
 - Biking and walking modes are excluded (sensitive to short distances only)
- $U_{ij} = \alpha + \beta_j x_i + \varepsilon_{ij}$ \longrightarrow Utility from choice $j =$ (Rail, Road_C, Road_S) for the individual user i
- Explanatory variables (x_i) including:
 - Quantitative data: age, frequency, minutes, costs
 - Categorical variables: user type (T.A. staff, students, professors); residence (VA, CO and OTHER); destination (Varese, Como); ownership of private cars; car pooling attitude; use of university shuttle bus (only Varese)
 - Residence dummy: respondents are clustered using administrative data (ISTAT and law 59/97) to account for proximity-effects among users

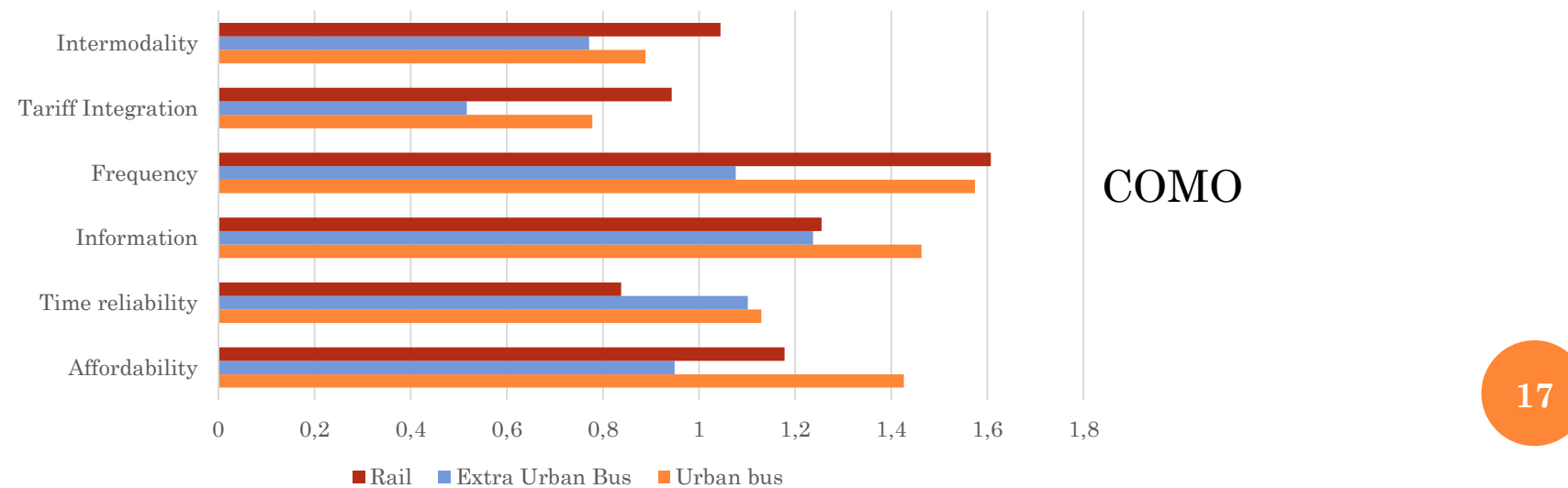
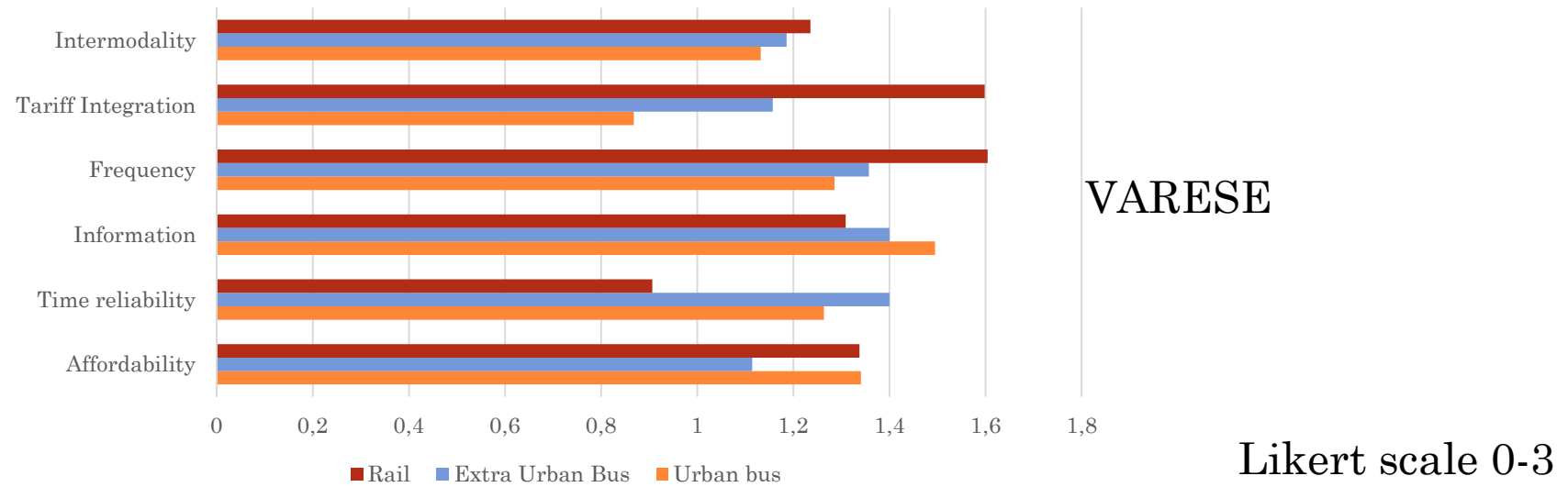
VARIABLES	AGGREGATE (Pseudo R2: 0.3608)		VARESE (Pseudo R2: 0.4103)		COMO (Pseudo R2: 0.2410)	
	Rail	Road_C	Rail	Road_C	Rail	Road_C
Age	-0.0532*** (0.0126)	-0.0481*** (0.0150)	-0.0789*** (0.0173)	-0.0576*** (0.0198)	-0.0231 (0.0187)	-0.0276 (0.0224)
Travel time	0.0620*** (0.00407)	0.0334*** (0.00431)	0.0735*** (0.00532)	0.0363*** (0.00589)	0.0457*** (0.00684)	0.0314*** (0.00736)
Trip frequency	0.193*** (0.0517)	0.290*** (0.0556)	0.159** (0.0639)	0.269*** (0.0694)	0.248*** (0.0911)	0.344*** (0.0983)
Trip cost	-0.00889*** (0.00232)	-0.0218*** (0.00253)	-0.00715** (0.00280)	-0.0232*** (0.00314)	-0.0136*** (0.00438)	-0.0177*** (0.00462)
Staff	-0.526 (0.424)	0.475 (0.510)	0.302 (0.512)	0.583 (0.585)	-2.594*** (0.873)	0.553 (1.194)
Student	-0.379 (0.410)	0.649 (0.583)	-0.883 (0.556)	-0.166 (0.712)	-0.0638 (0.593)	2.546** (1.204)
Car_own	-3.630*** (0.248)	-3.856*** (0.244)	-3.733*** (0.297)	-4.119*** (0.292)	-3.011*** (0.461)	-3.280*** (0.462)
Shuttle_bus			1.463*** (0.162)	1.022*** (0.180)		
Car_pooling	-0.672*** (0.135)	-0.00465 (0.141)	-0.684*** (0.164)	0.319* (0.179)	-0.760*** (0.243)	-0.542** (0.246)
VA (origin)	0.655 (0.406)	0.852*** (0.260)	-0.692** (0.338)	0.886*** (0.238)		
OTHER (origin)	1.894*** (0.329)	0.0819 (0.225)			1.398*** (0.382)	-0.137 (0.307)
Varese (destination)	-1.668*** (0.155)	-1.864*** (0.168)				
Constant	0.354 (0.834)	2.432** (0.988)	0.943 (1.056)	1.663 (1.253)	0.269 (1.223)	-0.366 (1.713)
Observations	2 586	2 586	1 914	1 914	672	672

Standard errors in parentheses; Significance levels: *** p<0.01, ** p<0.05, * p<0.1; ROAD_S (Car) is the reference group

PREDICTED PROBABILITIES

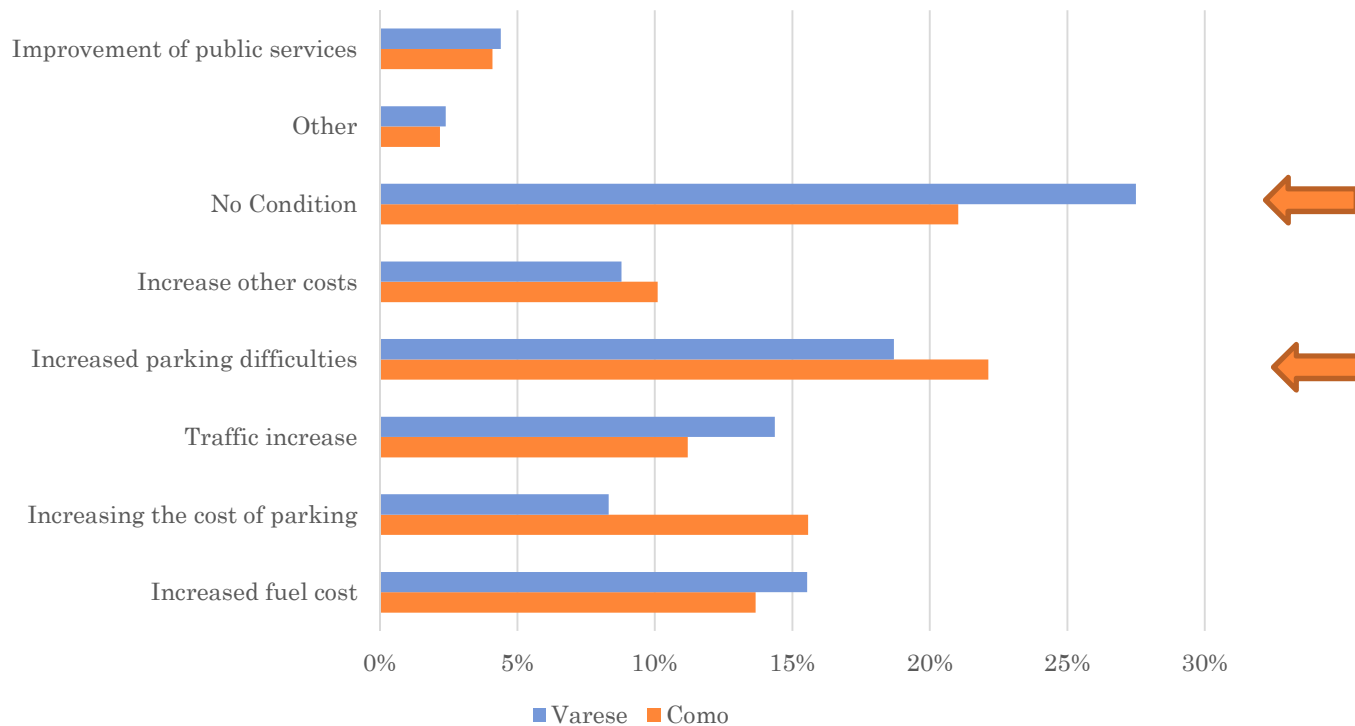
	RAIL	ROAD_C	ROAD_S
COMMUTING MODES (aggregate)	<i>Predicted probability</i>	<i>Predicted probability</i>	<i>Predicted probability</i>
CO#Como	0.122*** (0.0326)	0.436*** (0.0470)	0.443*** (0.0481)
CO#Varese	0.0430*** (0.0132)	0.127*** (0.0253)	0.830*** (0.0307)
OTHER#Como	0.469*** (0.0288)	0.275*** (0.0247)	0.257*** (0.0241)
OTHER#Varese	0.228*** (0.0166)	0.110*** (0.0109)	0.662*** (0.0195)
VA#Como	0.138*** (0.0297)	0.602*** (0.0466)	0.261*** (0.0408)
VA#Varese	0.0683*** (0.0159)	0.246*** (0.0296)	0.686*** (0.0347)
Observations	2,586	1,914	672

TRANSPORT PUBLIC SERVICES EVALUATION



PROPENSITY TO CHANGE

Car Pooling			
University Pole	Yes	No	Favorable
Varese	44%	17%	39%
Como	30%	26%	45%
Role	Yes	No	Favorable
Student	45%	15%	40%
Professor	22%	36%	42%
T.A. Staff	17%	39%	43%



CONCLUSIONS

- The role of mobility on economics is essential, and it needs to be managed with a special attention to sustainability.
- Considering the related literature there is a special focus, emerged in the last decade, about commuting and the location of university offices in urban or decentralized environments.
- The availability of parking in Varese and the higher accessibility of Como by public transport services create two different universes. In the first pole, the use of car is stimulated by the abundant parking availability and by the lack of transport public services. On the other hand, Como population presented a higher propensity to the use of sustainable means of transport, with differences related to the role.

CONCLUSIONS

- In the complete regression model the predominance of the car obscure some effects that can be highlighted in the “Cities Models” (e.g. Staff)
- Cluster mode analysis: the trip origin influences the modal choice
- Resistance to change for a consistent number of users
- Different evaluation of some public transport services by users in Varese with respect to Como.
- Policy implication: results can help university to identify possible policies to increase the use of sustainable means of transportation (according to the local authorities).

**Thank you for your
attention!
Any questions?**

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