CASE STUDY:

Fezzi, C., Bateman, I. J., and Ferrini, S. (2014). Using revealed preferences to estimate the value of travel time to recreation sites. *Journal of environmental economics and management*, 67, 58-70.

EE465/EE463 Project Evaluation

Semester 2/2015

Summary of the Paper

- This paper uses revealed preference approach to estimate the value of travel time (VTT) for recreation trips based on traveling choices between alternative routes (free access road vs. toll roads).
- VTT is estimated from the toll costs per hour of time saved (€/h).
- Case-study sites: three beaches located on the Italian Riviera Romagnola.
- The estimated VTT is between €8.4/h and €9.4/h.
- A Monte Carlo simulation shows that ¾ of the wage rate is a reasonable approximation of the average VTT for recreation trips.

Models of Value of Travel Time (VTT)

- Becker (1965)
  - Use a combination of revealed preference and stated preference data to estimate a value of time.
  - It assumes fixed time and monetary prices for each good.
  - The value of time (or the shadow price) is uniform in all activities.
- DeSerpa (1971)
  - Relaxes Becker's assumption by fixing only the monetary costs while allowing the amount of time spent on each activity to vary depending on individuals' preferences.
  - The shadow value of time is replaced by a value of saving time specific to each activity.
  - This is possible by assuming inequality in time consumption constraints.

Empirical Setting and Data (1)

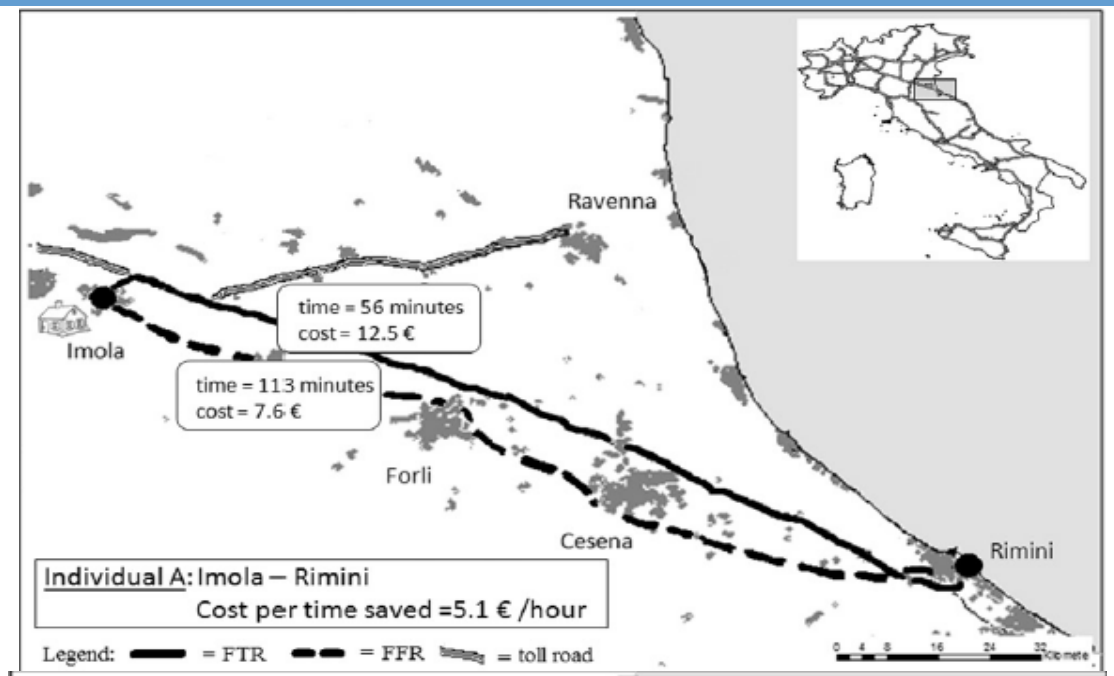
- This study uses DeSerpa's framework to estimate a VTT for recreation sites.
- It requires observations on individuals facing trade-offs between travel costs and driving time to recreation sites.
  - Need information from more than one site to see variation in travel time and travel costs of a particular person.
  - Need information from more than one person to have variation for the same recreation site.
- Key question: how individuals choose between different routes to travel to a given site, with each route option characterized by different travel time and monetary costs.

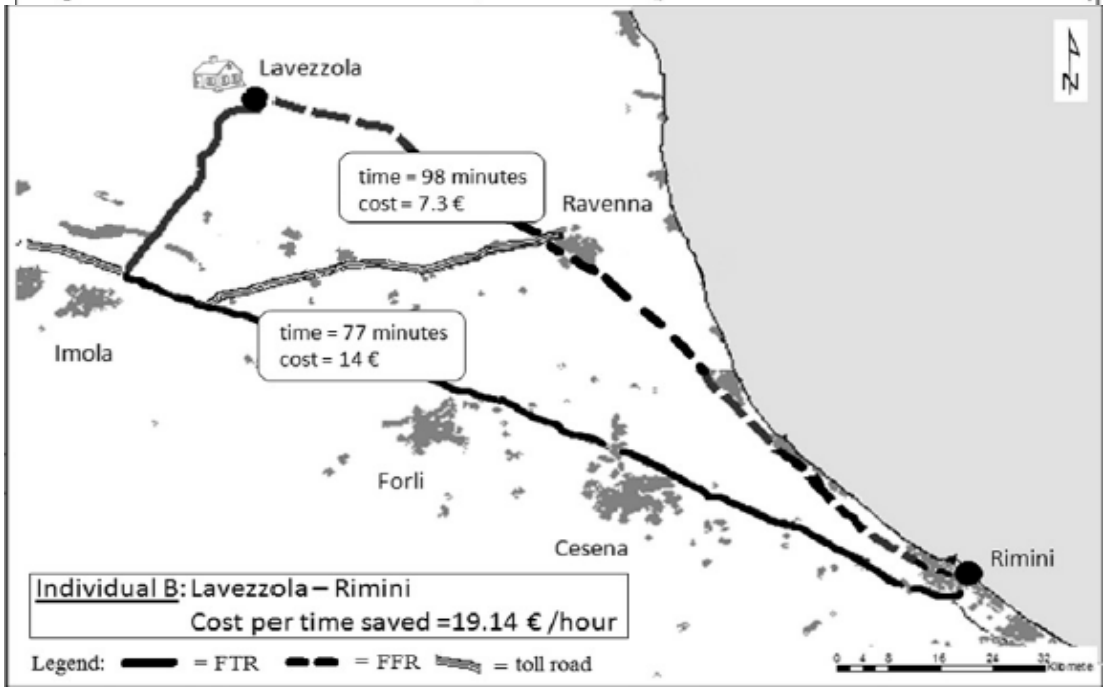
Empirical Setting and Data (2)

- The probability of person *n* choosing to visit site *s* and using route *j* is:

$$P_n(s,j) = P_n(S)P_n(j|s)$$

- Case study - 3 beaches on the Italian Riviera Romagnola:
  1. Rimini
  2. Cesenatico
  3. Igea-Marina.
- Possible routes: free-access roads and toll roads.
- Use google map to calculate a proxy for expected travel time.
- Assume average gas consumption of 1 L/18 km & use average gas price.





Possible routes and costs per time saved for two individuals living in different cities:

1. Imola

→ save >1h at a cost €5/h

2. Lavezzola

→ save 20 min at a cost €20/h.

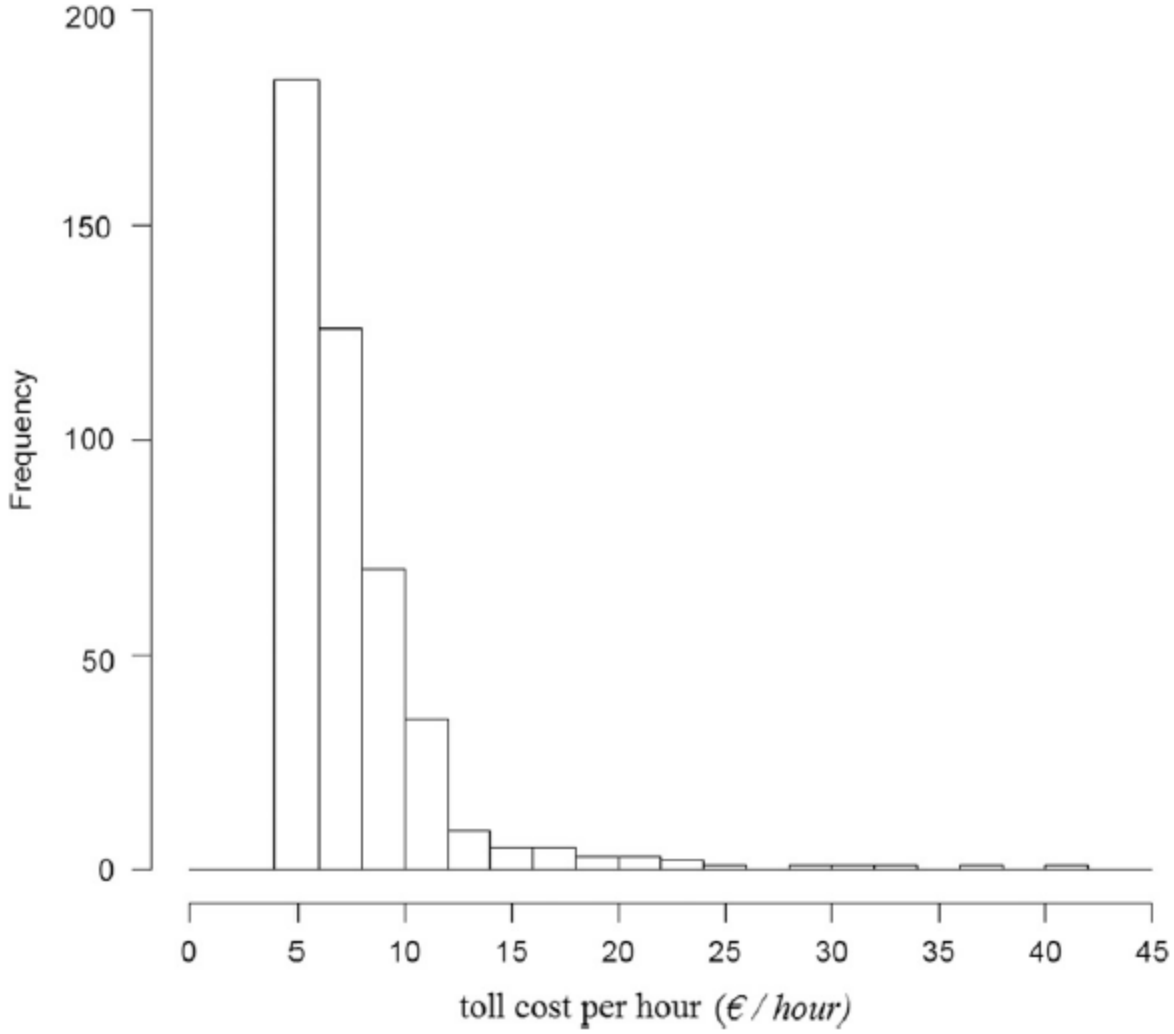
Routes' Descriptive Statistics

Route	Time (min)			Fuel cost (€)	Toll cost (€)	Include bypass	Include mountain road	Include scenic road	% Chosen
	Mean	Min	Max	Mean	Mean	Mean	Mean	Mean	
FTR	137.8	28.0	495.0	16.22	11.26	0.09	0.02	0.00	56
FFR	233.9	35.0	763.0	15.49	0.00	0.16	0.09	0.07	15
FT1A	148.7	37.0	498.0	16.35	10.29	0.17	0.02	0.00	14
FT1B	144.7	35.0	502.0	16.32	10.76	0.09	0.02	0.00	4
Other routes	174.2	84	418.0	17.25	9.35	0.25	0.01	0.00	11

Possible routes:

1. Fastest Free Route (FFR)
2. Fastest Toll Route (FTR)
3. FT1A: Fastest route access the toll road one station after that used in the FTR.
4. FT1B: Fastest route exiting the toll road one station before that used in the FTR.

Histogram of Toll Cost Per Hour of Travel Time Saved



Respondents' Descriptive Statistics

	$\bar{x}$	$\hat{s}(x)$	Min	Max	$\bar{x}$ (y=FTR)	$\bar{x}$ (y=FFR)	$\bar{x}$ (y=other)
Personal income (€1000/month)	2.11	1.33	0.25	11.20	2.15	2.33	1.92
Age (years)	40.70	12.17	18.00	76.00	40.00	43.38	40.51
Gender	0.29	0.45	0	1	0.30	0.29	0.26
People in the car	2.85	1.13	1	7	2.89	2.54	2.92
> 16 Years old	2.27	0.86	1	7	2.32	2.07	2.27
< 16 Years old	0.59	0.84	0	4	0.57	0.47	0.65

Empirical Specification

- The (dis-)utility that person *n* receives from choosing route *j* is:

$$U_n(j) = U_{n,j} = \lambda_n c_{n,j} + \theta_n t_{n,j} + q_j + \varepsilon_{n,j}$$

Where $t_{n,j}$ = the route time

$c_{n,j}$ = the route costs (toll and fuel)

θ_n = marginal disutility of spending time driving

λ_n = marginal utility of money

q_j = observed characteristics of route

- The value of travel time is the ratio of the marginal disutility of time spent driving to the marginal utility of money:

$$VTT = \frac{\theta_n}{\lambda_n}$$

Model Estimates and Corresponding VTT

	Preference space	*VTT space*				
	Model A1 *base model*	Model A2 *base model*	Model B *route characteristics*	Model C *route and respondent characteristics*	Model D *unobserved heterogeneity (Gaussian)*	Model E *unobserved heterogeneity (Triangular)*
Time	−3.031*** (0.361)	0.858*** (0.072)	0.835*** (0.107)	0.700*** (0.136)	0.777*** (0.121)	0.712*** (0.122)
s.e. (Time)					0.218*** (0.051)	
Cost	−3.533*** (0.543)	−3.533*** (0.543)	−2.996*** (0.549)	−3.116*** (0.562)	−6.626*** (1.461)	−6.166*** (1.263)
s.e. (Cost)					3.396*** (0.888)	
FTR			−0.425*** (0.089)	−0.394*** (0.083)	−0.166*** (0.047)	−0.175*** (0.047)
FFR			−0.416*** (0.110)	−0.440*** (0.113)	−0.263*** (0.073)	−0.262*** (0.073)
Bypass			−0.243* (0.144)	−0.234** (0.112)	−0.151*** (0.063)	−0.153*** (0.065)
Scenery			0.218 (0.266)	0.225 (0.211)	0.153 (0.171)	0.232 (0.171)
Mountain			0.612*** (0.233)	0.629*** (0.221)	0.549*** (0.187)	0.537*** (0.188)
*Time * gender*				0.039 (0.108)	0.016 (0.093)	0.052 (0.088)
*Time * d_age ≥ 60*				−0.305*** (0.119)	−0.321*** (0.107)	−0.302*** (0.119)
*Time * p_inc*				0.091* (0.053)	0.085* (0.048)	0.092** (0.036)
*Time * one_day*				0.138 (0.141)	−0.003 (0.106)	0.054 (0.107)
Log-likelihood	−580.06	−580.06	−500.31	−492.83	−483.33	−485.98
Pseudo R^2	0.13	0.13	0.25	0.26	0.28	0.27
Mean WTP (€/h)	8.58	8.58	8.35	9.26	9.35	9.16

Notes: travel cost expressed in €10 (e.g. €100=10), travel time in hours, and gross income in €1000/year (e.g. €20,000/year=20).

Empirical Results

- Model A: use only route time and costs as choice attributes
  - Estimated VTT is ~ €8.6/h
- Model B: include route characteristics:
  - FTR and FFR are more likely to be chosen than other routes
  - Estimated VTT is ~ €8.35/h
- Model C: include both route and respondent characteristics
  - Income has a positive effect, and older respondents have lower VTT.
  - Estimated VTT is ~ €9.26/h
- Model D & E: include unobserved tastes heterogeneity
  - Estimated VTT is ~ €9.16/h - €9.35/h

Monte Caro Simulation: Welfare Estimates Using Different VTT

	Mean WTP (€)	*5% Quantile of WTP (€)*	*95% Quantile of WTP (€)*
True VTT_n	9.29 (*8.61, 10.10*)	0.57 (*0.47, 0.71*)	11.47 (*10.26, 12.83*)
$VTT_n=0$	2.88 (*2.67, 3.13*)	0.18 (*0.14, 0.22*)	3.56 (*3.18, 3.99*)
$VTT_n=1/3w_n$	7.21 (*6.68, 7.85*)	0.44 (*0.36, 0.54*)	8.91 (*7.9, 9.98*)
$VTT_n=w_n$	11.99 (*11.11, 13.05*)	0.74 (*0.60, 0.92*)	14.81 (*13.25, 16.59*)
$VTT_n=3/4w_n$	10.03 (*9.28, 10.04*)	0.61 (*0.50, 0.76*)	12.39 (*11.07, 13.89*)
$VTT_n=3/4\overline{w}$	9.78 (*9.06, 10.64*)	0.60 (*0.45, 0.74*)	12.06 (*10.82, 13.52*)

Notes: results generated with 5000 Monte Carlo repetition, w_n indicates the person specific wage rate and $\overline{w}$ indicates the sample mean wage rate. In brackets is the 95% confidence intervals.

Average WTP Estimates