



The Determinants of Car Ownership and Use

Nick Johnstone, Ysé Serret and Clotilde Bureau

Presented at ...

OECD Conference on
'Household Behaviour and Environmental Policy'

3-4 June 2009

OECD Headquarters, Paris

Reducing Environmental Impacts of Car Use

The environmental impacts of car use can be reduced through:

- Reducing the number of vehicle kilometres driven;
- Switching from car use to other transport modes which are less damaging; and,
- Use of less polluting vehicles (e.g. electric or hybrid vehicles).

Research Questions Proposed (not necessarily addressed)

- Determinants of ownership of alternative fuel vehicles (too few 1's);
- Determinants of mode choice (Guevara-Sangines and Lara-Pulido 2009); and
- For given mode selected - reduction of use of vehicle.

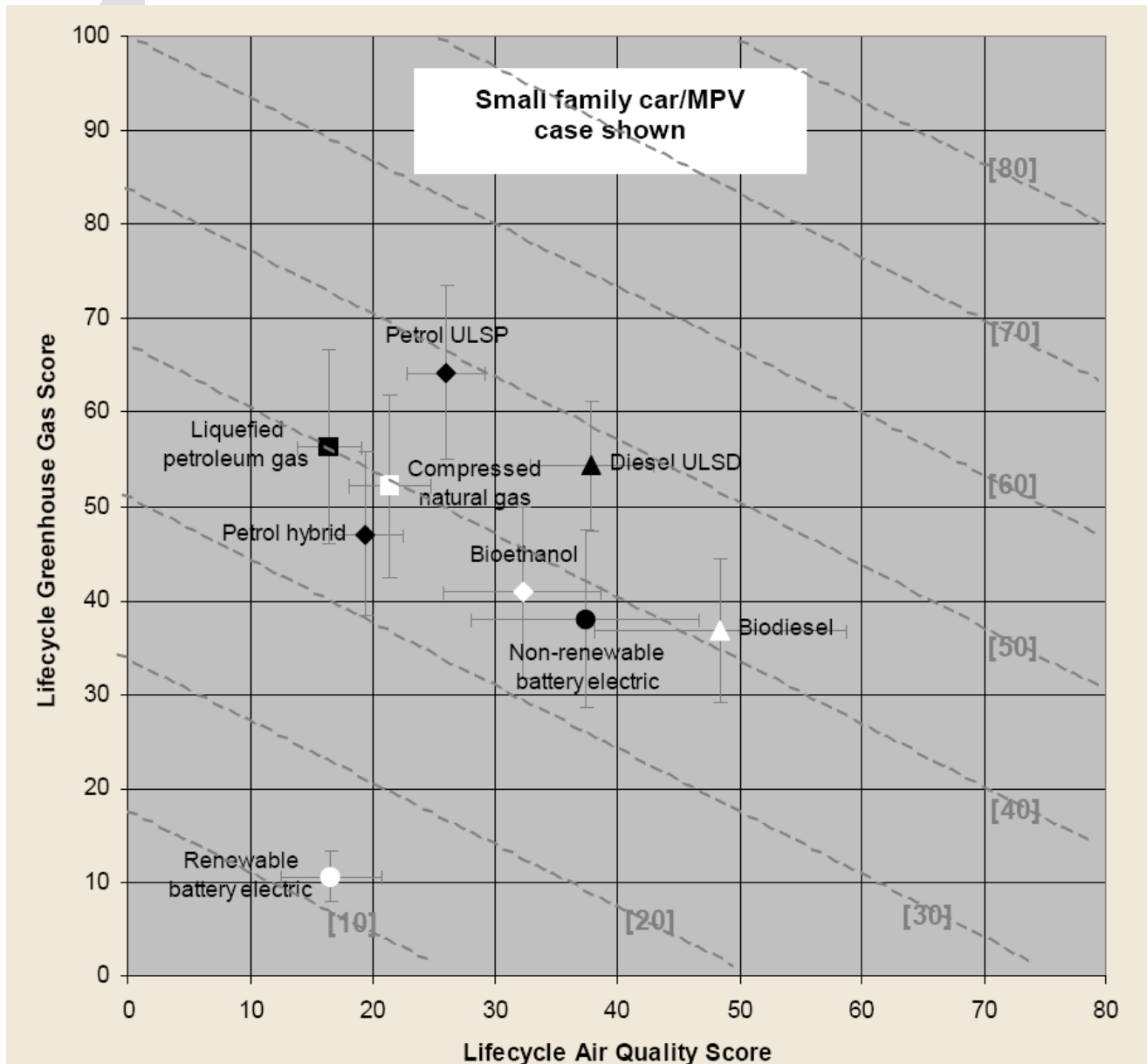
Previous Literature

- A large number of papers which model such decisions, often simultaneously. However, usually on the basis of a panel within a single country
- Given the nature of the data (single cross-section; omitted variables) – contribution to two questions: decision to own ‘a’ car, and given ownership of ‘a’ car how much used. Focus on:
 - Fuel price (imperfect proxy)
 - Access to public transport (minutes most convenient stop)
 - Environmental attitudes/norms
- Latter two – ‘modest’ contribution to the literature

Determinants of Car Ownership and Use

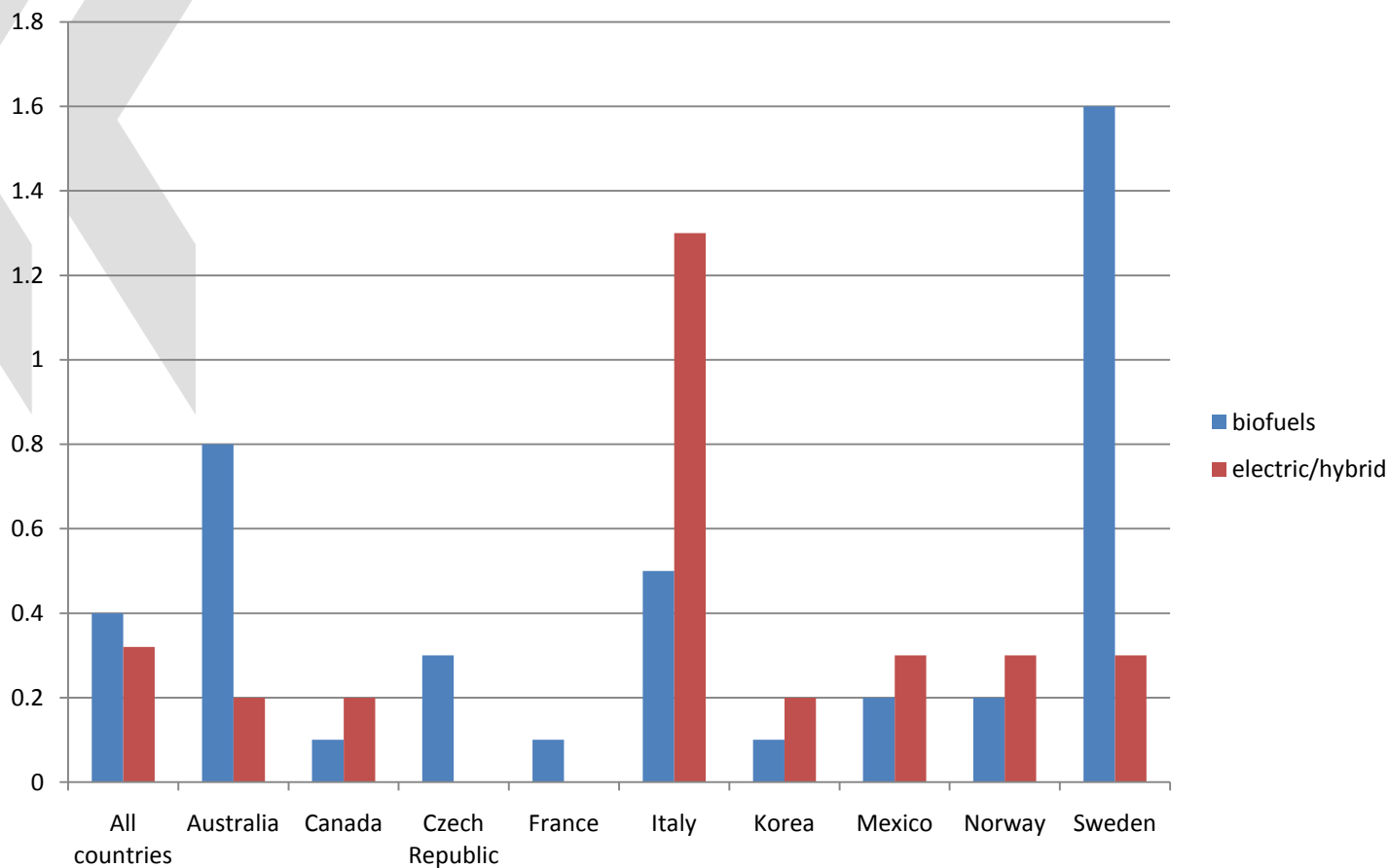
- As noted - the two choices are reflections of a much larger decision-making process – how to get from A to B, where A and B are themselves endogenous
- Moreover – different degree of intra-household interdependence for the two decisions – i.e. competition for car, ‘free riding’
- Observations from a single cross-section can not be expected to yield robust estimates – but can provide some qualified insights into determinants of ownership and use
- In this paper, model as Heckman Selection – decision to own a car => use of car if owned.

Vehicle Choice and Environmental Impacts

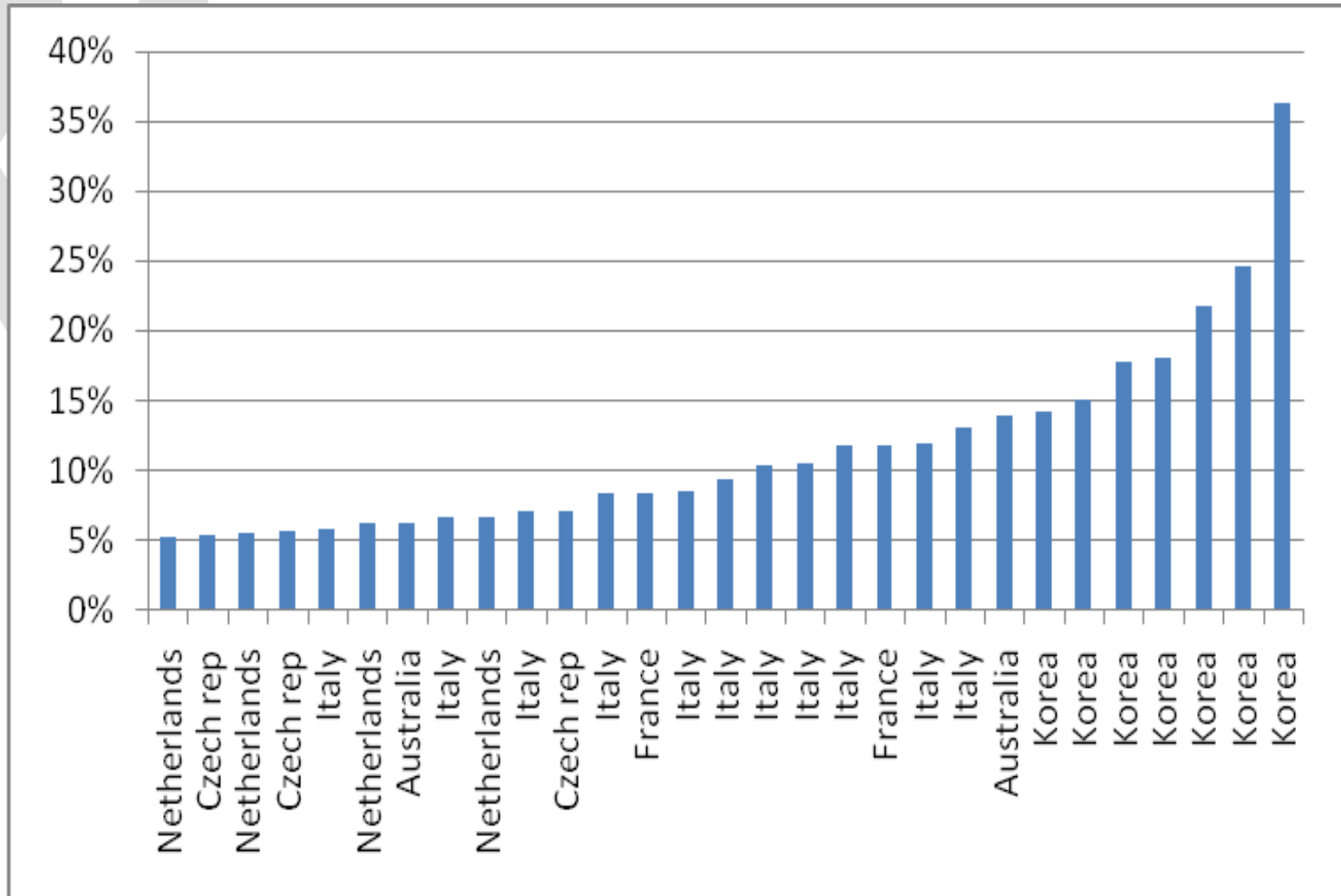


Source:
Lane (2006)

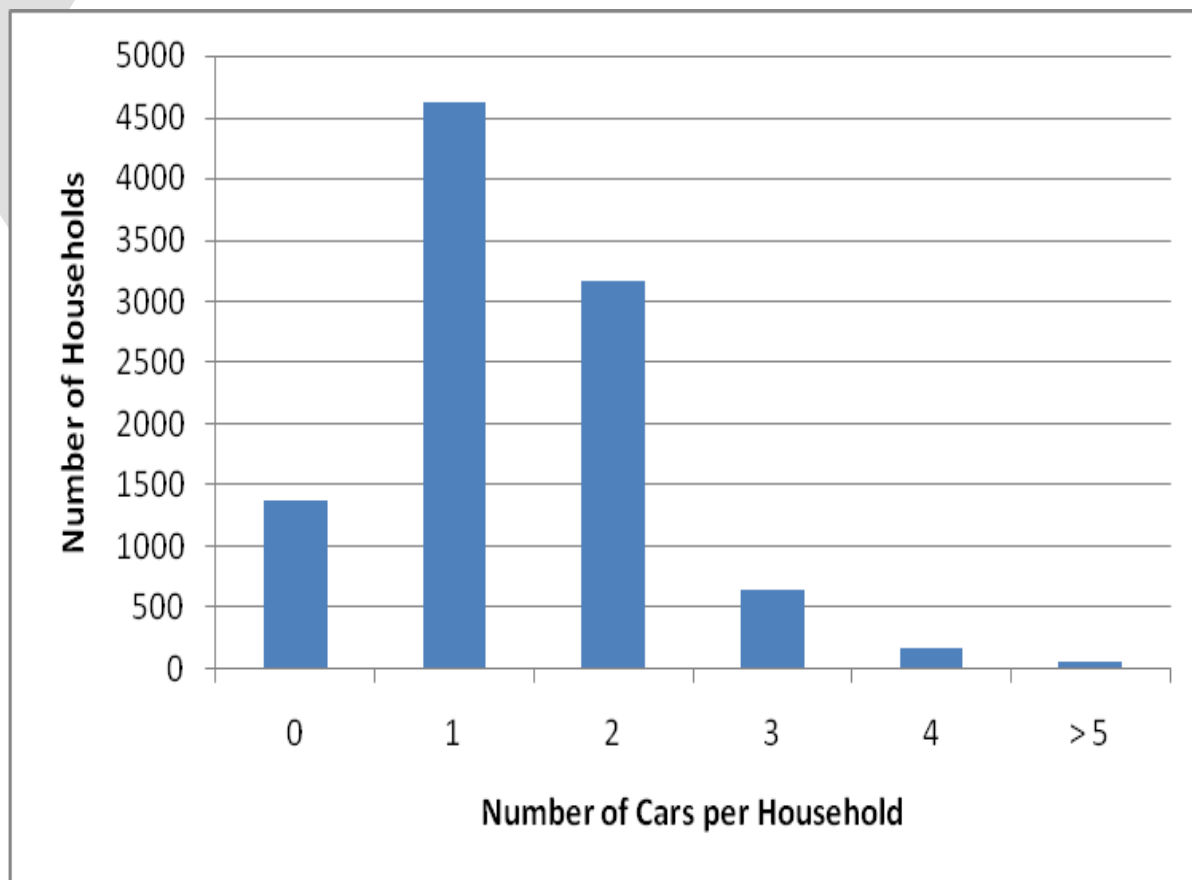
Evidence on Use of AFVs in Sample (1)



Evidence on Use of AFVs in Sample (2)



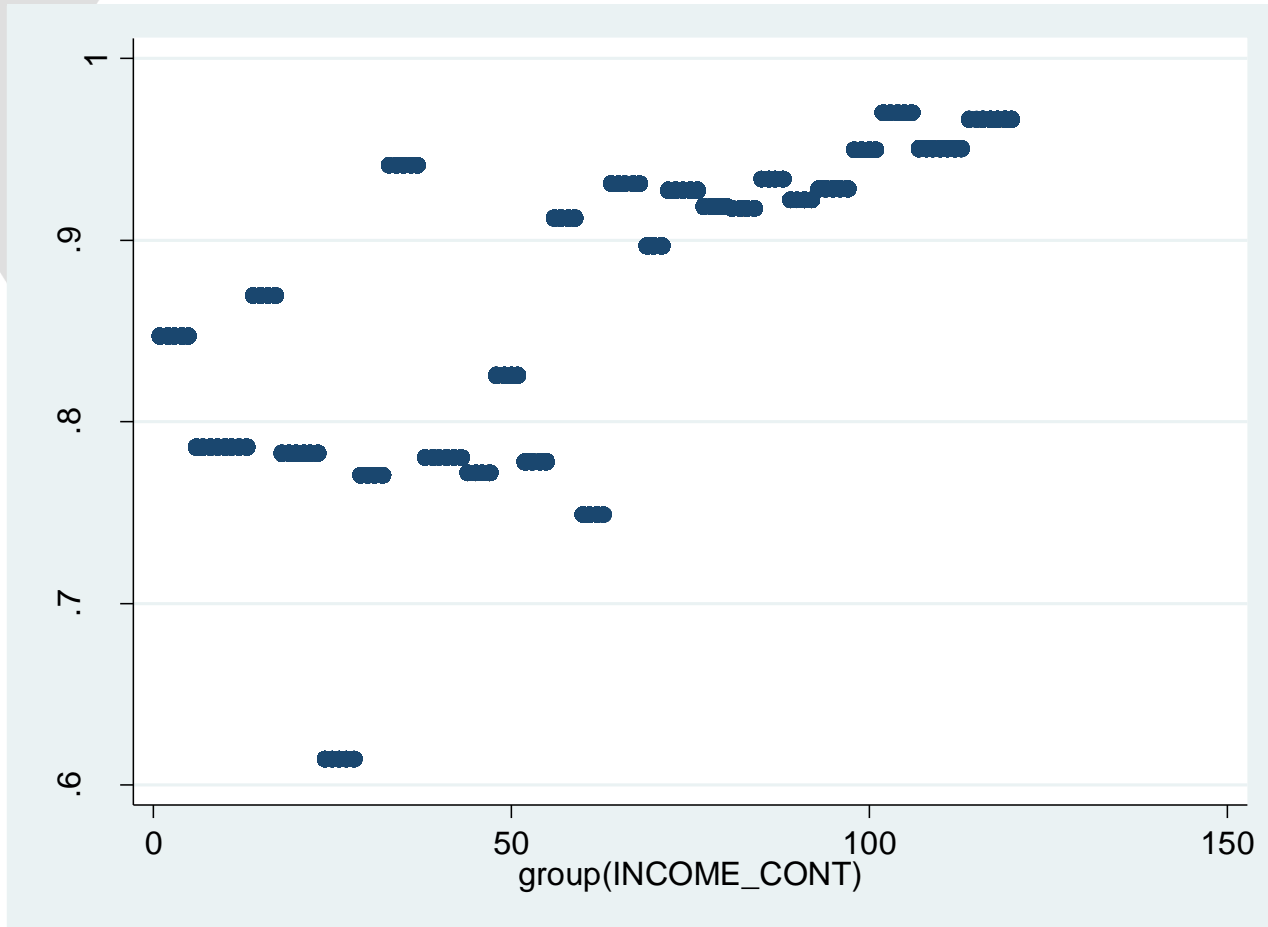
Car Ownership in Sample (1)



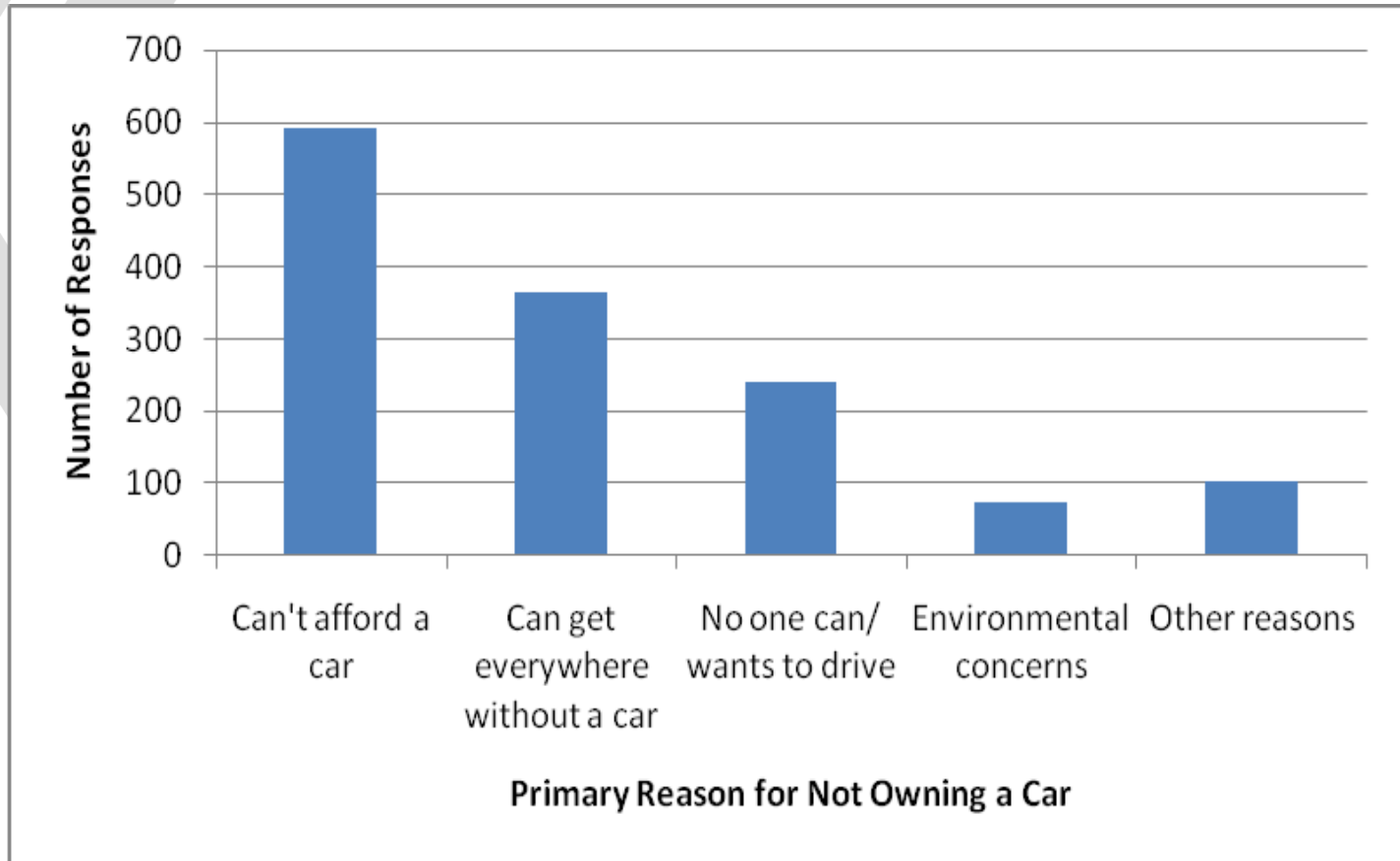
Car Ownership in Sample (2)

Country	Mean per HH	St. Dev.	Mean per capita	St. Dev.	Observations
Canada	2.424	.910	.711	.267	984
Netherlands	1.997	.730	.656	.265	1010
France	2.505	.794	.756	.278	1055
Mexico	2.558	1.040	.590	.303	969
Italy	2.720	.861	.715	.249	1397
Czech Rep	2.226	.892	.598	.264	694
Sweden	1.985	.847	.654	.308	987
Norway	2.410	.873	.733	.304	985
Australia	2.629	.931	.731	.264	986
Korea	2.152	.705	.489	.200	963

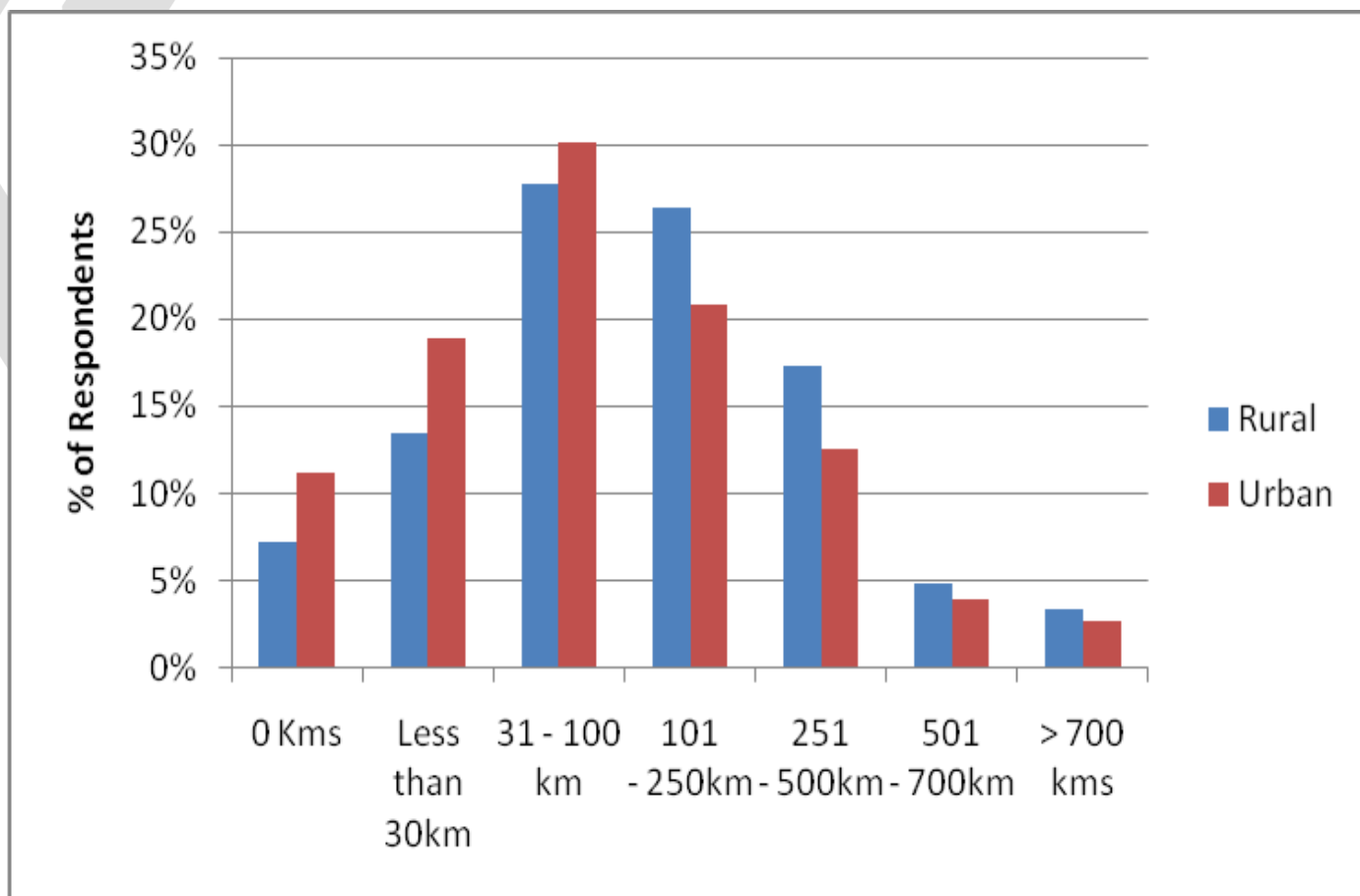
Car Ownership and Income



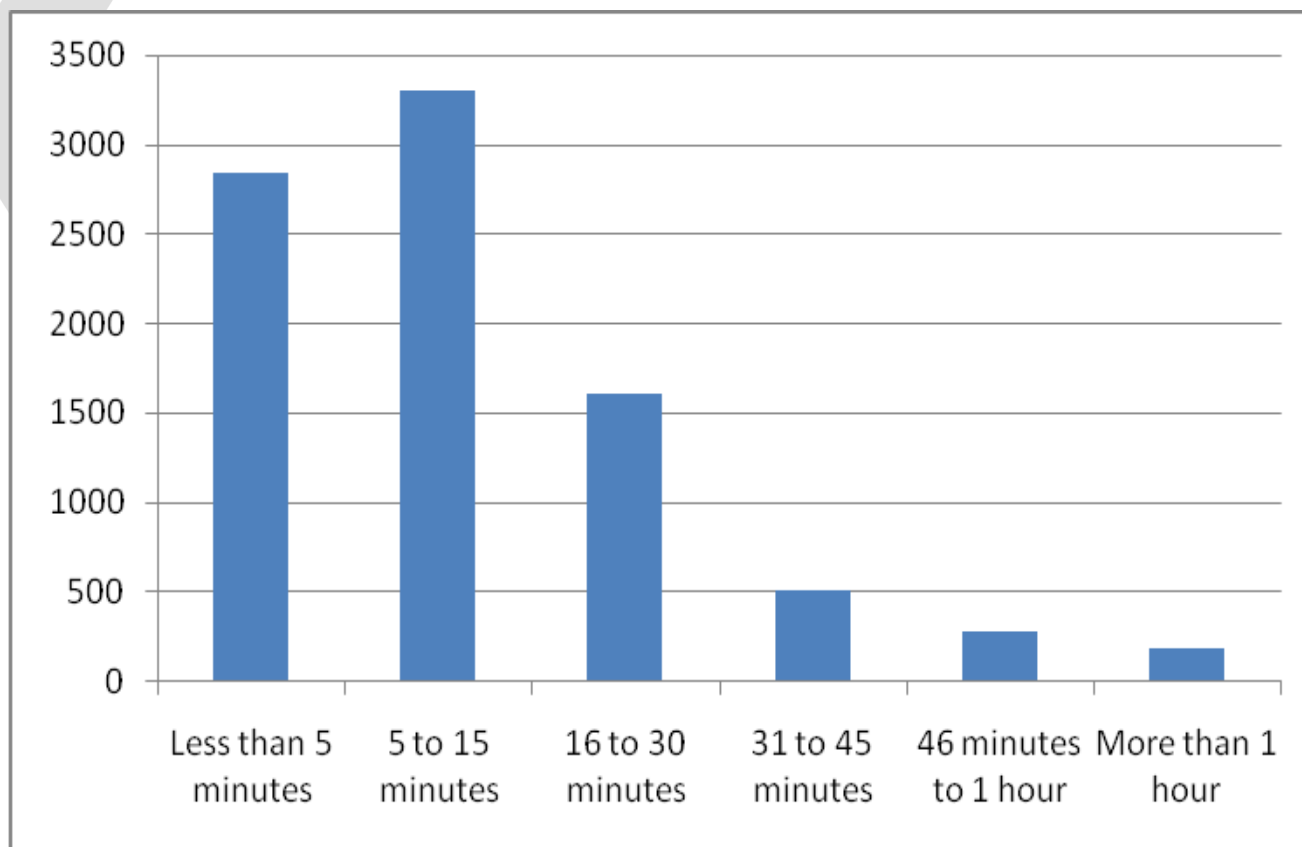
Reported Reasons for Not Owning a Car



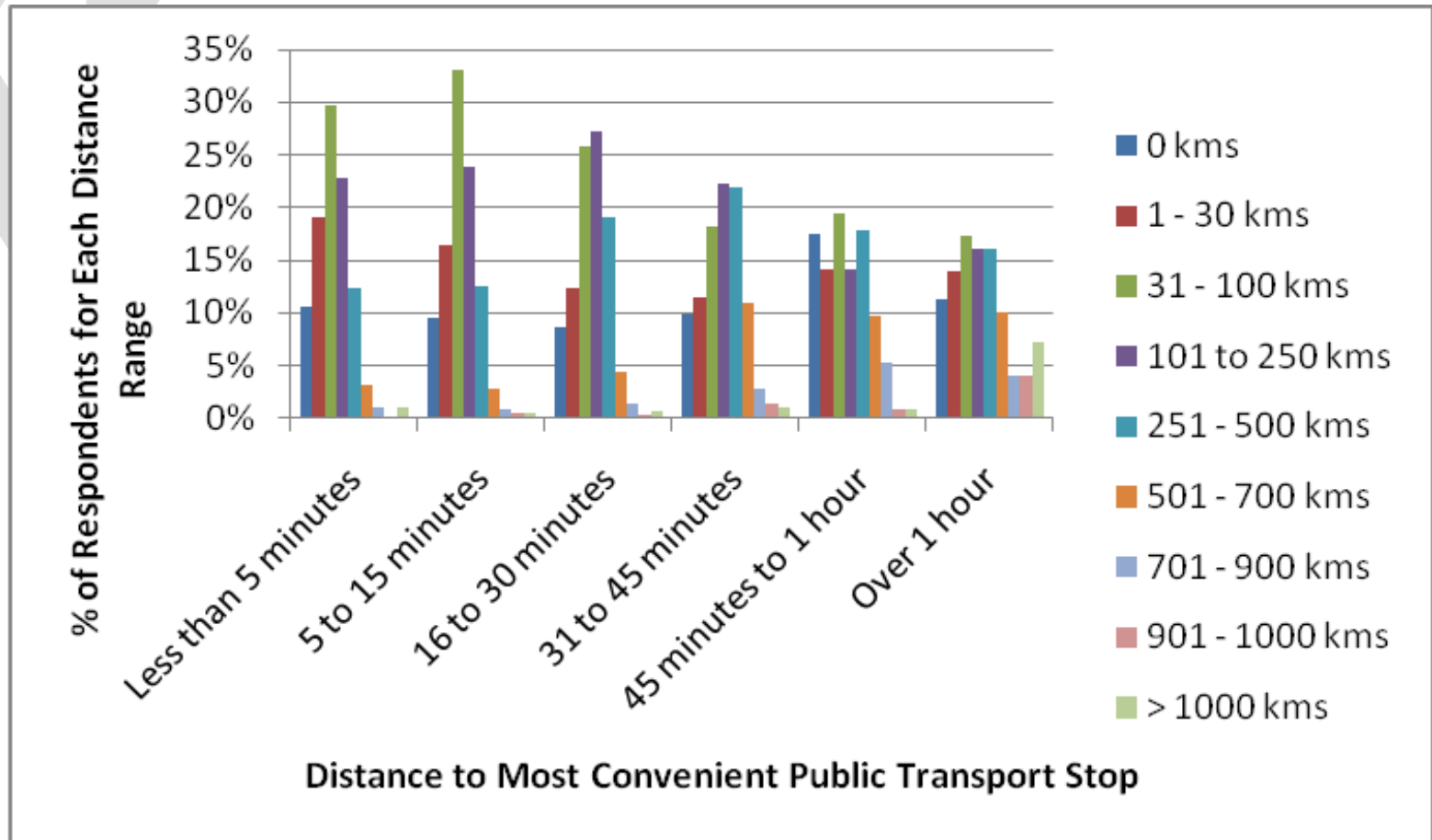
Reported Avg. VKMT Amongst Respondents in Car-Owning Households



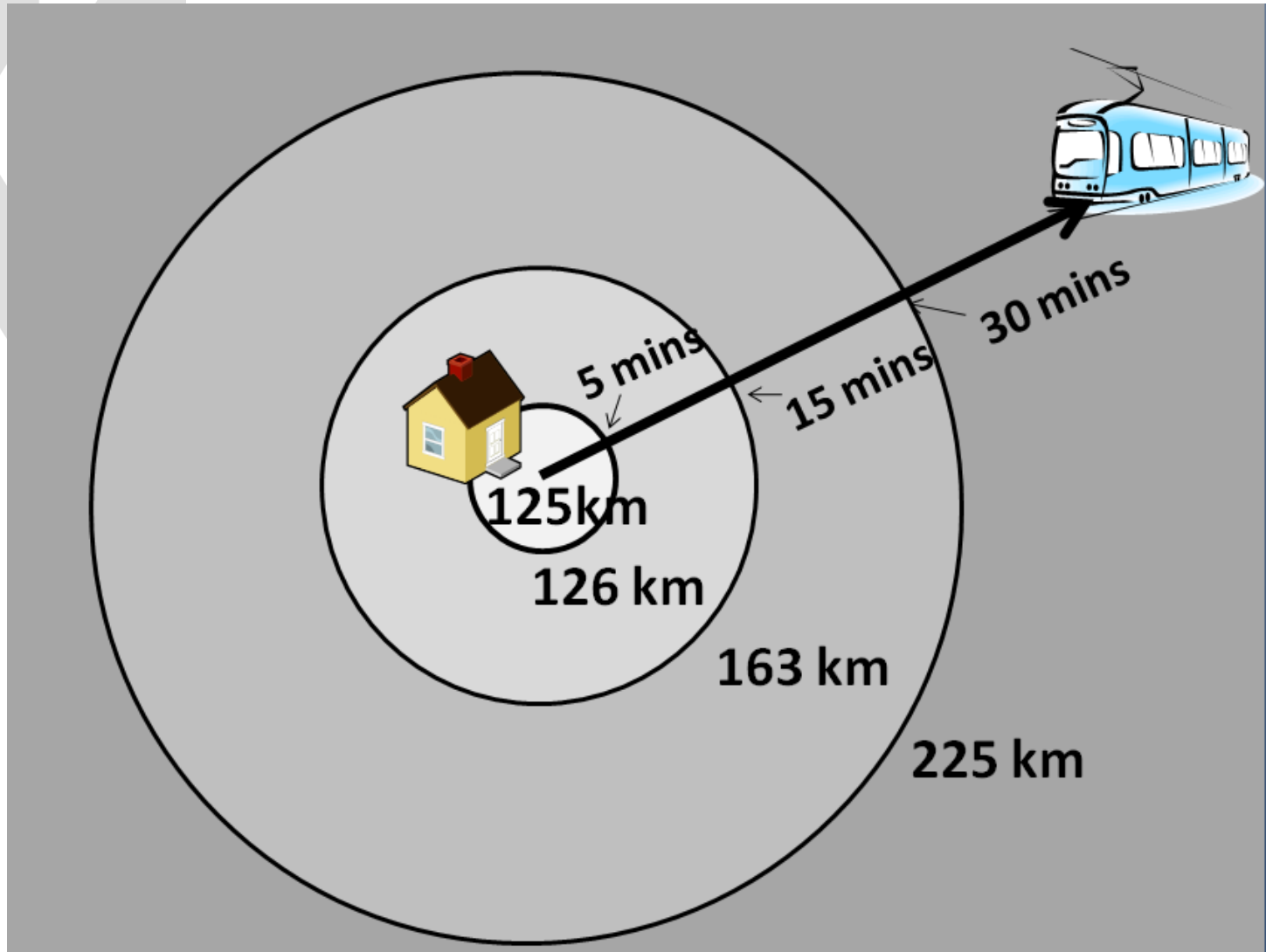
Reported Convenience (Time) of Closest Public Transport Station or Stop



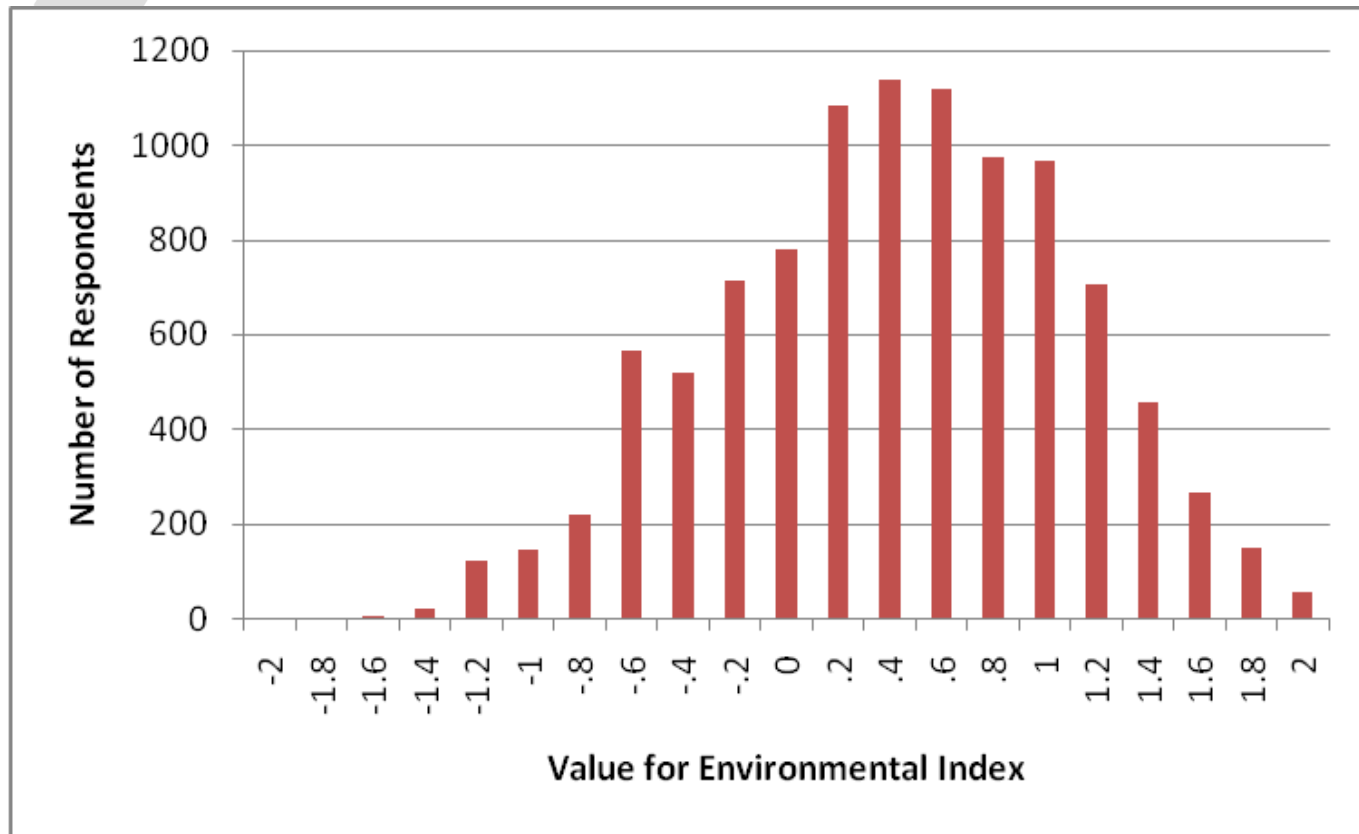
Convenience of Closest Public Transport and VKMT (1)



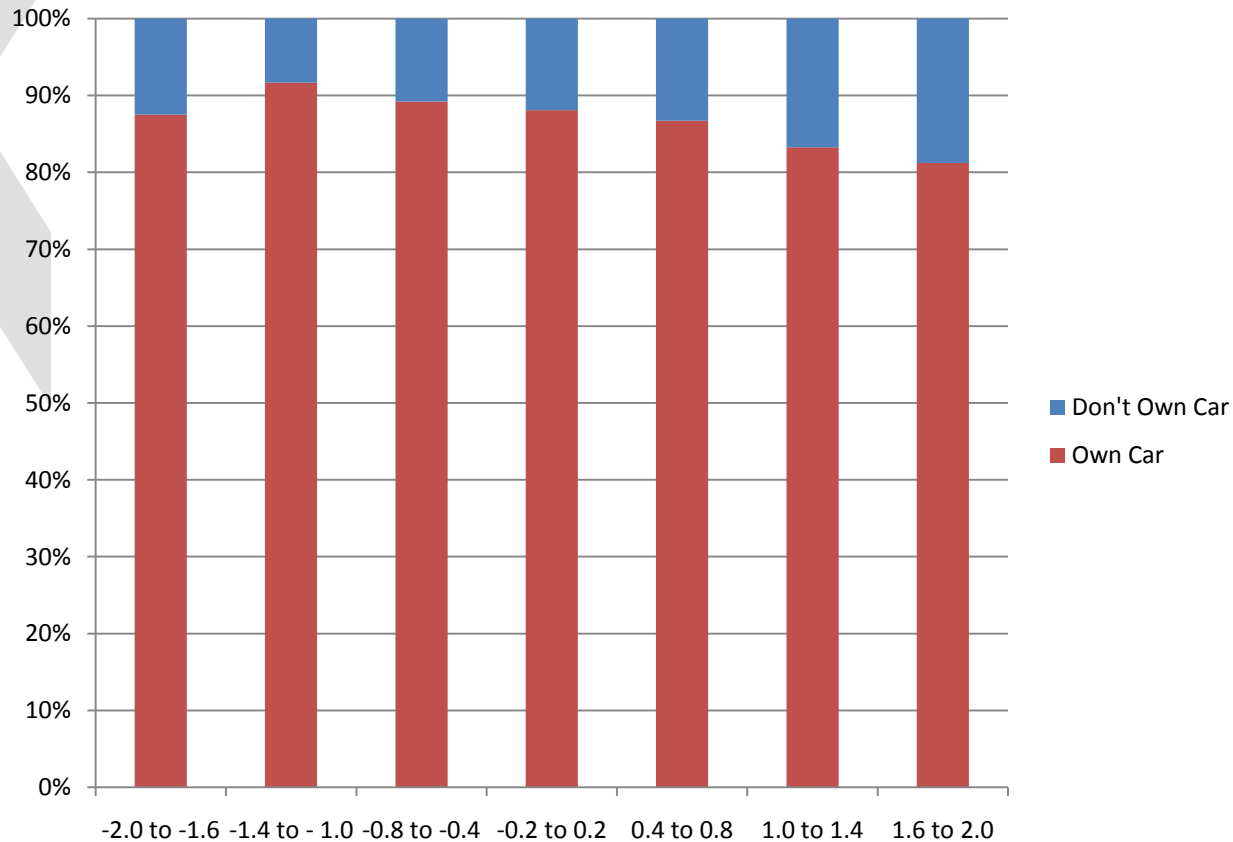
Convenience of Closest Public Transport and VKMT (2)



Environmental Attitude Index



Environmental Attitude Index and Car Ownership



Determinants of Car Ownership and Use (1)

- On basis of previous empirical evidence, significant factors include:
 - Economic factors (e.g. income, employment, vehicle prices, fuel costs.....);
 - Spatial/land use factors (e.g. population density, transport infrastructure...);
 - Socio-demographic factors (e.g. age, gender, HH size, children,);
 - Attitudinal factors/norms (e.g. concern for the environment)

Descriptives

	Observations	Mean	Std. Dev.
CAROWN	6478	0.81	0.39
CARDIST	5119	191.95	200.61
FUELCOSTS	5144	0.083	0.301
HHSIZE	6478	2.81	1.43
AGE	6478	43.13	14.04
MALE	6478	0.53	0.50
UNDER5_CHILD	6478	0.15	0.36
PT_ACCESS5	6478	0.33	0.47
PT_ACCESS5-5-15	6478	0.38	0.49
URBAN	6478	0.47	0.50
INCOME	6478	29880.16	21603.06
EMPLOYED	6478	0.63	0.48
ENVATTITUDE	6478	0.42	0.68

Model of Ownership and Use

$$CAROWN_i^* = \beta_c + \beta_2 D_i + \beta_3 X_i + \beta_4 L_i + \beta_5 E_i + \epsilon_i$$

$$CAROWN_i = \begin{cases} 1 & \text{if } CAROWN_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$CARDIST_i^* = \gamma_c + \gamma_2 D_i + \gamma_3 X_i + \gamma_4 L_i + \gamma_5 E_i + \mu_i$$

Results of Car Ownership ‘Selection’ Equation

CAROWN	Coeff.	Std. Error	z	P > z	Conf.	Interval
HHSIZE	0.12	0.02	7.33	0.00	0.09	0.15
AGE	0.04	0.01	4.70	0.00	0.03	0.06
AGEAGE	0.00	0.00	-3.38	0.00	0.00	0.00
MALE	0.31	0.04	7.76	0.00	0.23	0.39
UNDER5_CHILD	0.16	0.06	2.52	0.01	0.04	0.28
PT_ACCESS5	-0.13	0.05	-2.59	0.01	-0.23	-0.03
PT_ACCESS5-15	0.07	0.05	1.43	0.15	-0.03	0.17
URBAN	-0.45	0.04	-10.71	0.00	-0.53	-0.37
INCOME	0.02	0.00	13.91	0.00	0.00	0.00
EMPLOYED	0.26	0.04	5.80	0.00	0.17	0.34
ENVATTID	-0.09	0.03	-2.97	0.00	-0.15	-0.03
_cons	-1.43	0.20	-7.03	0.00	-1.83	-1.03

Results of VKMT Equation

	Coeff.	Std. Error	z	P > z	Conf.	Interval
CARDIST						
FUELCOSTS	-13.15	1.06	-12.41	0.00	-15.23	-11.07
HHSIZE	9.73	2.65	3.67	0.00	4.53	14.92
AGE	3.45	1.51	2.27	0.02	0.48	6.41
AGEAGE	-0.04	0.02	-2.45	0.01	-0.07	-0.01
MALE	67.98	6.78	10.03	0.00	54.70	81.26
PT_ACCESS5	-67.67	7.26	-9.32	0.00	-81.90	-53.44
PT_ACCESS5-15	-69.85	6.67	-10.48	0.00	-82.92	-56.78
URBAN	-37.83	8.07	-4.69	0.00	-53.64	-22.02
INCOME	1.12	0.00	4.82	0.00	0.00	0.00
EMPLOYED	29.39	7.27	4.04	0.00	15.15	43.63
ENVATTID	-7.11	4.21	-1.69	0.09	-15.36	1.14
_cons	26.69	51.21	0.52	0.60	-73.69	127.06

Conclusions

- Main determinants (previous literature) all have expected sign, and often statistically significant – but need panel
- Fuel price matters – but can not be compared with evidence from previous studies
- Environmental affects the decision to own a car, but not use once owned. Analogous to other results.
- Effect of access to infrastructure transport on ownership only significant for < 5 minutes, while use affected < 15 minutes
- Surprisingly (and implausibly) – ownership decision and convenience of access to public transport are not endogenous.