Explaining Differences in Car Ownership Motivations between Students from Developed and Developing Countries

Car ownership levels are increasing rapidly in many developing countries due to rising income levels. Contrary to this is the discussion on "peak car" in developed countries. Peak car is a hypothesis that travel by passenger vehicles has not grown much recently in a number of the highest income economies, and has even declined, where more income no longer translates into more car travel when income is very high (International Transport Forum, 2011). Several studies in developed countries report about reduced car usage among younger people relative to older generation (Kunimhof et al, 2013; Van Der Waard et al, 2012). To propose appropriate policies aiming to reduce car usage in developing countries, it is necessary to understand factors influencing the decision to buy a car in these.

In Belgiawan et al (2014) we report survey results of undergraduate students in seven different countries, asking about questions related to attitudes, norms and socio-demographic factors and correlate those with the likelihood to buy a car in the future. In total we obtained 1229 samples from seven countries: The Netherlands (N=84), Japan (N=142), United States (N=226), Taiwan (N=139), Indonesia (N=200), China (N=167) and Lebanon (N=271). We find that income levels only partially explain car purchase intention. There is instead a significant difference between developing and developed countries with students in developed countries having less desire to purchase cars. Attitudinal factors toward cars such as the *Symbolic Affective* and *Independence* aspects of the car have a positive correlation with car purchase intention. We further find that the *expectation of others to buy a car* plays an important role.

The objective of this paper is to build on the descriptive results of the previous study by using ordinal logistic regression (OLR) and advanced econometric models to understand the influence of attitudes toward car factors and social norms toward the likelihood to purchase cars in the future. We use the same data and the same variables as in Belgiawan et al (2014). As dependent variables we use *intentions to buy a car in the future* (next 10 years), which was measured on a 7-point Likert scale (very unlikely – very likely). For attitudes/perceptions we use questions that were posed on a 7-point Likert scale with verbally defined endpoints (strongly disagree – strongly agree). Six attitudinal questions are grouped into the *Symbolic Affective* factor: *Cars allow to distinguish oneself from others, cars are trendy, cars bring prestige, cars are cool, cars allow to express oneself, cars are fun to have.* Five further attitudinal questions are grouped into an *Independence* factor: *Cars are convenient, cars give freedom to travel anytime, cars help*

one to save time when making a trip, cars are useful to pick up or drop off others.

To measure the impact of social norms we construct the factor "expectation of others to buy a car" (EOA). For this we asked respondents "To what extent does each of the following groups (1. Your parents, 2. Your partner, 3. Your family members and relatives, 4. Your close friends, 5. Your classmates, friends and peers at university, 6. People in your neighborhood and 7. People in your province/state) expect you to buy a car within the next 10 years?" Responses to this group of questions were measured on a 7-point Likert scale ranging from "they strongly expect me not to buy a car" to "they have no expectation" as middle point and "they strongly expect me to buy a car" as the other end point.

Table 1 Car Ownership Intention Model

Variable	Developed Countries (Japan, Netherlands, US)		(Rapidly) Developing Countries (Taiwan, China, Indonesia, Lebanon)		All Samples	
	Value	t-test	Value	t-test	Value	t-test
Symbolic Affective	0.278	3.22	0.207	2.9	0.389	5.32
Independence	0.623	5.47	0.309	4.84	0.463	4.53
Expectation of others (EOA)	0.467	4.97	0.389	4.41	0.565	6.84
EOA Dummy (0 for no answer)	0.03	0.15	0.294	1.99	-0.272	-1.32
mu_nondev (scale parameter)					0.535	4.3
threshold1	-2.99		-3.73		-3.69	
threshold2	-1.85		-2.806		-2.66	
threshold3	-1.189		-1.986		-1.949	
threshold4	-0.575		-0.976		-1.137	
threshold5	0.605		-0.023		-0.127	
threshold6	1.795		1.297		1.123	
Number of estimated parameters:	10		10		11	
Sample size:	452		777		1229	
Null log-likelihood $LL(0)$:	-2291.538		-4693.713		-6985.251	
Final log-likelihood $LL(\beta)$:	-788.221		-1253.645		-2072.649	
$-2[LL(0)- LL(\beta)]$:	3006.633		6880.136		9825.203	
ρ^2 (rho-square):	0.656		0.733		0.703	
Adjusted ρ^2 (rho-square):	0.652		0.731		0.702	

Table 1 shows the OLR estimation using Python Biogeme (Bierlaire, 2003). In

initial tests we included further socio demographics attributes that proved to be not significant in some or all countries. *Symbolic Affective, Independence* and EOA are significant in all models. In Developed Countries, *Independence* appears to be the most influential factor while in Developing Countries EOA appears to be the most influential. We tested significant differences of individual coefficient between developed and developing countries using Eq. (2) (see Chapter 7, Ben-Akiva and Lerman, 1985) and find the independence rating is indeed statistically different. Students in developed countries appear to consider this "utility related" concept more in their choice.

In the fourth model we estimated in addition a scale parameter for developing countries (mu_nondev) while we fix the scale parameter for developed countries to 1. The result of the scale parameter reflects more variance in the unobserved part in the developing countries. We also tested whether the difference in the models for developed and developing countries is significant using the likelihood ratio test (Eq. 1) and confirmed that this is the case.

$$-2\left[\boldsymbol{\mathcal{L}}_N(\hat{\beta}) - \sum_{g=1}^{G} \boldsymbol{\mathcal{L}}_{N_g}(\hat{\beta}^g)\right] \quad (1)$$

$$\frac{\hat{\beta}_k^1 - \hat{\beta}_k^2}{(\mathrm{var}(\hat{\beta}_k^1) + \mathrm{var}(\hat{\beta}_k^2))^{1/2}} \quad (2)$$

Table 2 Test of equality of individual coefficient (Eq. 2)

Variable	**t-test**	
Symbolic Affective	0.634	
Independence	2.403	**
Expectation of others (EOA)	0.605	
EOA_dummy	-1.054	

While in this abstract the values of the latent variables were extracted based on factor analysis (principal component analysis), in the full paper we will advance this analysis by simultaneous estimation of the intention to buy a car and construction of the attitudinal and social norms factors by latent constructs. We will further test different formulations to test the importance of social norms. The above results do not consider that the expectation of some groups will impact the individual more than the expectation of others. We hence test, among others, following formulation where the construct *Subjective Social Norms* of an individual *i*, S_i, is constructed by interacting *the expectation of group k* with the *strength of influence of group k* to buy a car as in Eq. (3). Our

discussion will focus on the differences between the developing and the developed countries in our sample and point out policy implications.

$$S_i = \sum_{k=1}^{7} E_{ik}.I_{ik} \quad (3)$$

References:

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