



Modeling the Most Preferred Way of Using Autonomous Vehicles: Some New Evidences Based on a Stated-Choice Survey

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INTRODUCTION AND PURPOSE

The acceptance of AVs and its different forms of usage depends on the public's attitude and perception towards advanced technologies.

Hence a clear understanding how these perceptions affect Autonomous Vehicle (AV) adoption is important in accurately modeling consumers' choice behavior. Also difficult to account for the potential impacts of AV technologies on transportation without an adequate understanding of preferred way of adoption in the market.

This study aims to contribute to the existing literature through a systematic modeling effort aimed at unraveling relationships underlying this behavioral phenomenon through consumer perception of AV technology using Hybrid Choice Model (HCM).

Why Hybrid Choice Model?

"People are not logical. They are psychological."
-unknown

HCM can

- Incorporate cognitive process in decision making into discrete choice modeling
- Incorporate psychological factors for a behaviorally realistic representation of choice process

and hence enhance the explanatory power of choice modeling (Ben-Akiva et al (2002))

The structure of HCM model for this study is given in Figure 1.

METHODOLOGY

Structural Equation

Latent Variable model: f^1
 $X^* = h(X; \gamma) + \eta$ and $\eta \sim D(0, \Sigma\eta)$

Choice model: f^2
 $U = V(X, X^*; \beta) + \varepsilon$ and $\varepsilon \sim D(0, \Sigma\varepsilon)$

Measurement Equation: f^3
 $I = g(X, X^*; \alpha) + v$ and $v \sim D(0, \Sigma\varepsilon)$ (ordinal)

Choice as function of utilities: f^4
 $Y_i = \begin{cases} 1, & \text{if } U_i = \max \{U_j\} \\ 0, & \text{otherwise} \end{cases}$

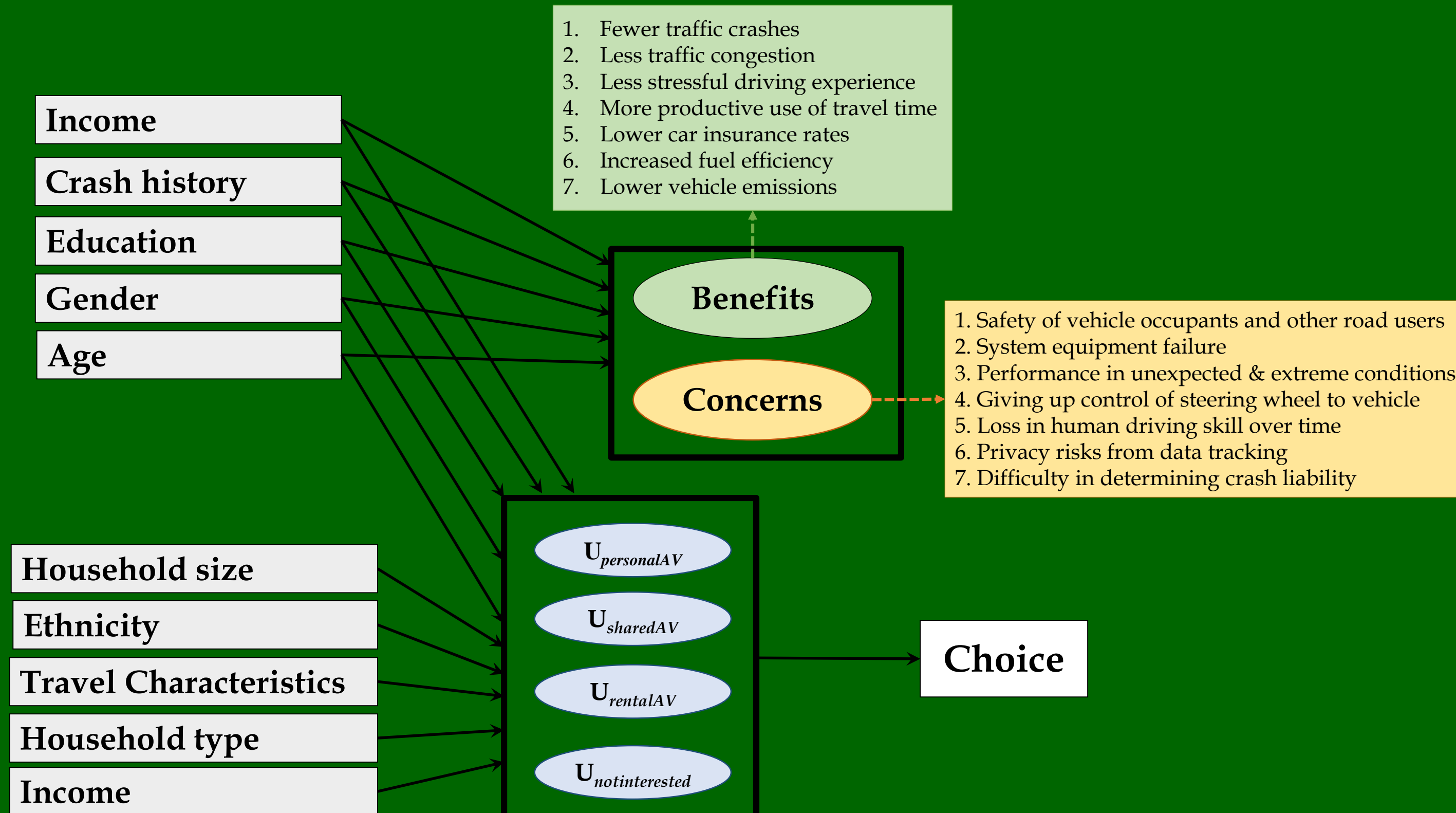


Figure 1. HCM model.

Table 2: Estimates from Structural Equation model for latent variables benefit and concern

Variable	Estimates					
	USF			AAA		
	Own AV	Own AV & Share	Rent AV & Shared AV Mobility	Own AV	Own AV & Share	Rent AV & Shared AV Mobility
Constant	-1.37	-2.82	-1.44	-0.04	-1.91	
Age > 40 years		0.84			1.27	
Male	0.40	0.16				
White			-0.49		-0.78	-0.39
Bachelor Degree or Higher			0.61		0.39	0.48
Commute Trip Distance < 3 miles			0.95			
Number of Drivers	0.43					
Household Size	-0.16			-0.21		
Number of vehicles in the household			-0.77			-0.35
Household Income < \$25k			0.45			
Ever Involved in a Traffic Crash	0.13				0.60	
Visited campus 1 day/week						
Visited campus 3 or more days/week		0.05	0.47			
Benefit Latent Variable	2.49	0.68	1.37	2.77	2.70	2.18
Concern Latent Variable	-1.27	-3.49	-1.24	-0.95	-1.77	-0.74

Table 1: Data Descriptive

Attributes	Levels	Survey %	
		USF	AAA
Sample	Sample Size	1157	1856
Gender	Female	63.3	40.6
Age	18-34	69.6	7.0
	35-64	28.1	50.0
	65 or older	2.3	37.5
	30 or older	43.0	94.0
	50 or older	13.1	77.2
Ethnicity	White	68.3	82.2
Education	Bachelor's degree or above	68.9	60.2
Household Income	Below \$50,000 per year	50.6	18.2
	Below \$100,000 per year	77.5	60.7
	\$100,000 or above	22.5	38.9
Household Size	1 person	14.6	20.0
	2 persons	36.5	50.1
	3 persons or more	48.9	26.8

Variables for Benefit LV	Estimates	
	USF	AAA
Age > 40 years	0.20	0.41
Male	0.07	
Working Respondent	0.12	
Commute Trip Distance < 3 miles	0.05	
Variables for Concern LV		
Age > 40 years	-0.08	
Male	-0.24	0.40
Bachelor Degree or Higher	-0.16	0.34
Ever Involved in a Traffic Crash	-0.05	0.68

DISCUSSIONS

Choices modelled:

1. Own (Own (purchase or lease) AVs and use them only for personal use or use by family members
2. Own (purchase or lease) an AV and earn extra income on the side by providing rides for fellow passengers when you use it or when not needed
3. Rent an AV as the need arises or Use AVs in the form of transportation (taxi, or public transit) provided by a service provider
4. Neither interested in investing in an AV nor using AVs as a transportation service

RESULTS

The results from the structural model with latent variables are given in Table 2.

From the results it is evident that people who have **encountered with a crash, travel less for their commute trips, workers, Younger individuals** including millennials and Gen X perceive benefits of the AV technology

Women are more likely to be associated with the concerns of the technology

Men are more inclined (than females) to be interested in both AV-ownership and **personal** use.

Higher educated people are more likely to rent an AV.

Younger adults aged less than 40 years old appear to be more inclined towards **owning AV and sharing** it than older people

White people are less likely to share and rent their AVs

Higher educated people are more likely to share and rent AVs.

With more human driven vehicles in the household less likely to rent AVs.

REFERENCES

1. Ben-Akiva, M., Walker, J., Bernardino, A. T., Gopinath, D. A., Morikawa, T., & Polydoropoulou, A. (2002). Integration of choice and latent variable models. Perpetual motion: Travel behaviour research opportunities and application challenges, 431-470.
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