



THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

Mobility-as-a-Service in Car-Dominated Cities

Modeling Individuals' Willingness-to-Share Trips with Strangers in an Autonomous Vehicle Future

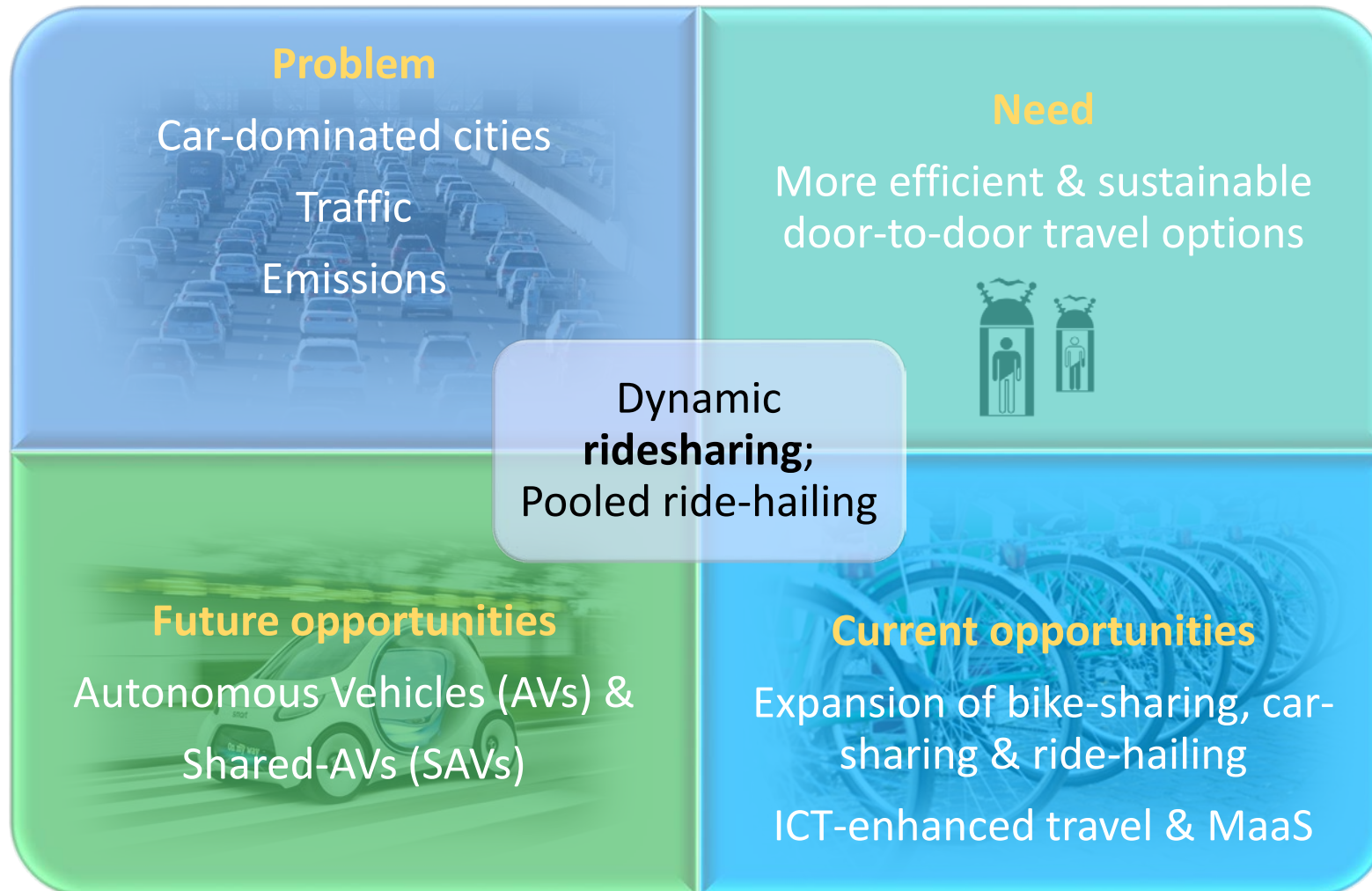
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Context



The Supply Perspective...

- Based on **data from taxi trips in Singapore**: if rides were split by multiple passengers there would be 20%–30% reduction on distances traveled (Wang et al., 2018)
- *“Without dynamic ride-sharing, the **additional empty** repositioning trips made by SAVs increased **congestion** and travel times. However, **dynamic ride-sharing** resulted in **travel times comparable to those of personal vehicles** because ride-sharing reduced vehicular demand.”* (Levin et al., 2017)
- *“DRS appears critical to avoiding new congestion problems, since **VMT may increase by over 8 % without any ride-sharing.**”* (Fagnant and Kockelman, 2018)
- **Greater the number of users willing to participate in the ridesharing system, easier the matching and better the travel times**

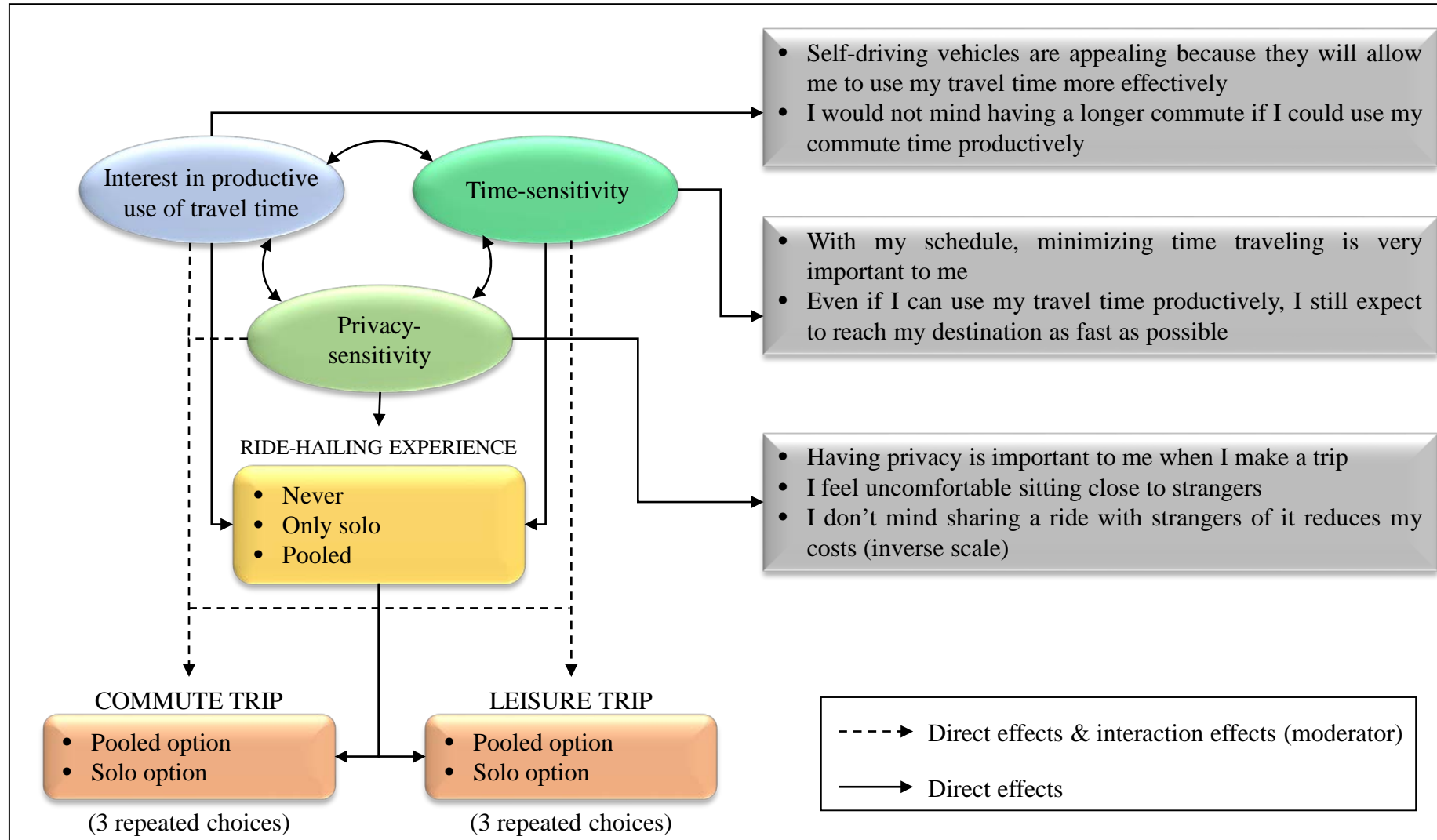
Dynamic ridesharing seems promising **BUT**
are travelers willing to share rides?



Objectives

- 1) Quantify willingness-to-pay to not share rides with strangers
 - Define distributions for different market segments
- 2) Understand user response to delays due to pick-up/drop-off of additional passengers
- 3) Understand the impacts of current ride-hailing behavior on willingness-to-share while controlling for self-selection effects

Behavioral Framework



Stated Choice Experiment



Imagine that ride-sourcing services (similar to Uber and Lyft) use self-driving vehicles for all of their clients. Imagine also that you plan to go out on a **leisure activity** and you will use one of these ride-sourcing services. In the three scenarios described below, which option would you choose?

- Orthogonal design – scenarios with dominant alternatives were removed
- Similar scenarios for commute trips
- Maximum number of additional passengers : 3

SCENARIO 2

**Call a private self-driving cab service
(similar to Uber/Lyft)**

Travel time: 20 min

Cost: \$ 19.5

No additional passengers

**Call a shared self-driving cab service
(similar to UberPool/LyftLine)**

Travel time: 30 min

Cost: \$ 16

Additional passengers: 2

SCENARIO 3

**Call a private self-driving cab service
(similar to Uber/Lyft)**

Travel time: 15 min

Cost: \$ 16.5

No additional passengers

**Call a shared self-driving cab service
(similar to UberPool/LyftLine)**

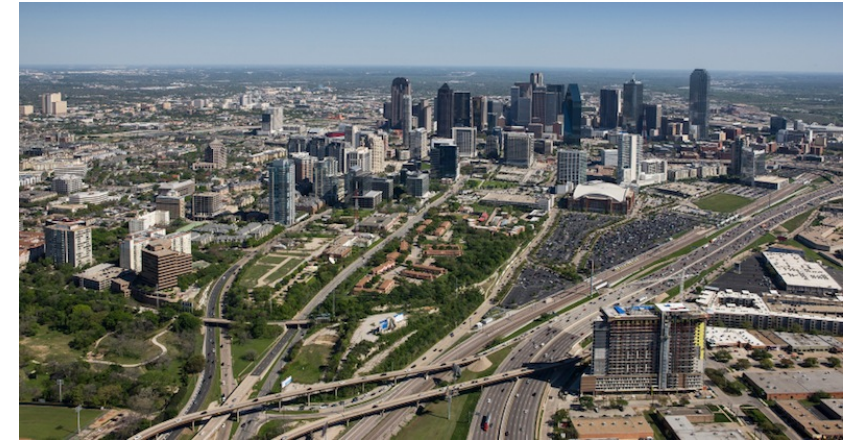
Travel time: 23 min

Cost: \$ 10

Additional passengers: 1

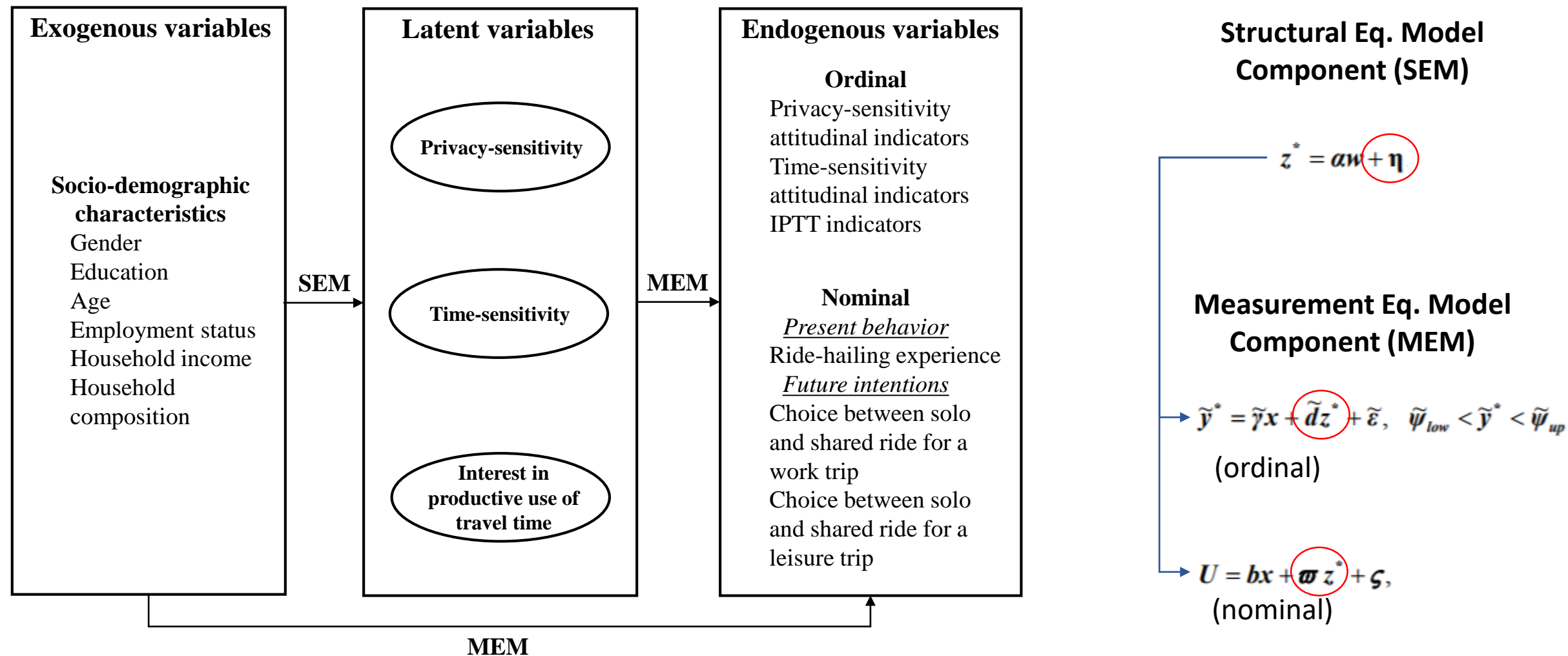
Sample

- Dallas-Fort Worth MSA
 - fastest growing metropolitan area in the U.S.
 - Car dominated and spread urban area
- **Survey distribution:** local transportation planning organizations, universities, private transportation sector companies, non-profit organizations, and online social media
- Sample of 1,607 commuters (Fall 2017)
- Overrepresentation
 - Middle-aged, males, non-Hispanic White individuals
 - Multi-worker and high-income households



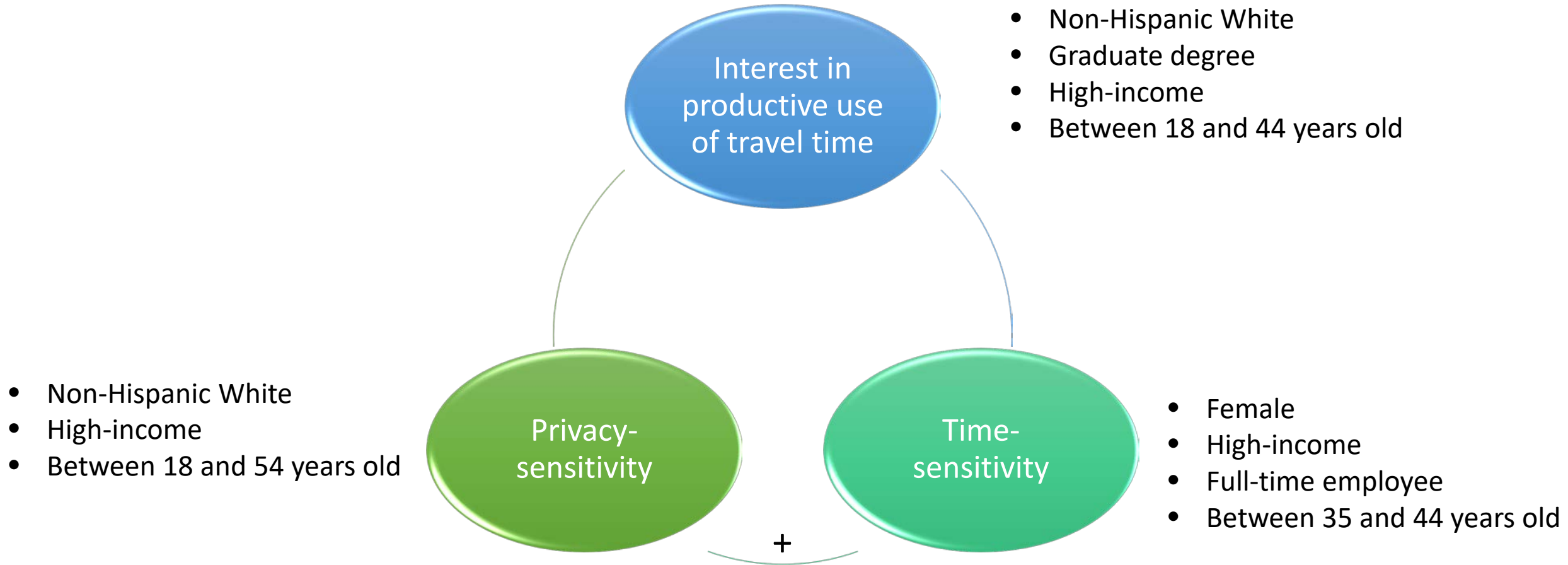
Population expansion: 3.4 million **workers**
53% has experienced ride-hailing
9% has experienced shared ride-hailing
26.5% < monthly
14.3% ≥ weekly

Modeling Methodology: Generalized Heterogeneous Data Model (GHDM) + Panel Choices



See Bhat, C.R. (2015), "A New Generalized Heterogeneous Data Model (GHDM) to Jointly Model Mixed Types of Dependent Variables," *Transportation Research Part B*
Bhat, C.R., and S.K. Dubey (2014), "A New Estimation Approach to Integrate Latent Psychological Constructs in Choice Modeling," *Transportation Research Part B*

Determinants of Psycho-social Constructs



Ride-hailing Experience: Selected Results



Solo ride-hailing

- age
+ income
+ self-employed
+ living alone
+ living in central areas
+ vehicle availability
+ Interest in productive use of TT



Shared ride-hailing

- age
+ income
- Non-Hispanic White
+ living alone or multi-worker HH
+ living in central areas
+ vehicle availability
- Privacy-sensitivity
+ Interest in productive use of TT

Base alternative:
never used ride-
hailing

Shared vs. Solo AV Trip: Selected Results



- **Privacy-sensitivity:** direct & moderating effects
- **Time-related constructs:** moderating effects only
- Vehicle availability, being a woman, being between 35 and 44 years old:
 - reduce interest in sharing for commute but not for leisure trip purpose
- Experience with solo ride-hailing reduces the likelihoods of choosing the shared alternative
- Experience with pooled has a positive effect even after controlling for common unobserved effects
 - Significant differences between leisure and work purposes

Sample WTS and IVTT

	Leisure Trip		Commute Trip	
	IVTT (\$/hour)	WTS (\$/add person)	IVTT (\$/hour)	WTS (\$/add person)
Median	\$ 23.10	\$ (0.91)	\$ 24.84	\$ (0.49)
Minimum	\$ 21.24	\$ (0.80)	\$ 17.45	\$ (0.45)
Maximum	\$ 24.19	\$ (1.02)	\$ 30.22	\$ (0.53)
Mean	\$ 23.05	\$ (0.89)	\$ 24.83	\$ (0.48)
Std. Dev	\$ 0.49	\$ 0.05	\$ 2.45	\$ 0.02

- WTS leisure trip: (\$0.80-3.06) → 4% to 55% of trip cost
- WTS commute trip: (\$0.45-1.59) → 2% to 29% of trip cost

Policy implications & Research Needs



- **Urgent** need to encourage individuals to **try shared rides now!**
 - (and discourage solo rides)
 - Significant effects even after controlling for self-selection
- **GOOD NEWS:** individuals' willingness-to-pay to NOT share rides for **commute** purposes is **lower**
- How can we reduce the privacy-sensitivity of Non-Hispanic Whites?
- Why are newer generations becoming more privacy-sensitive?
- Groups that are more time-sensitive also have direct effects that reduce the likelihood to choose the shared option
 - Women & individuals between 35 and 44
 - Children? Escorting trips? – need for more elaborate experiments (?)

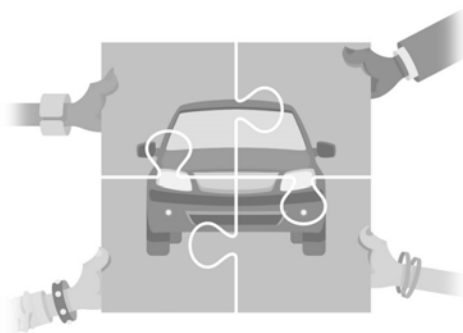


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Thank you

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