Gender Disparity on Transit Commuting Patterns: A Story of Austin, a Fast-Growing City in the Texas Triangle

Ziqi Liu, Ph.D. candidate in Community and Regional Planning,
School of Architecture, the University of Texas at Austin

The University of Texas at Austin

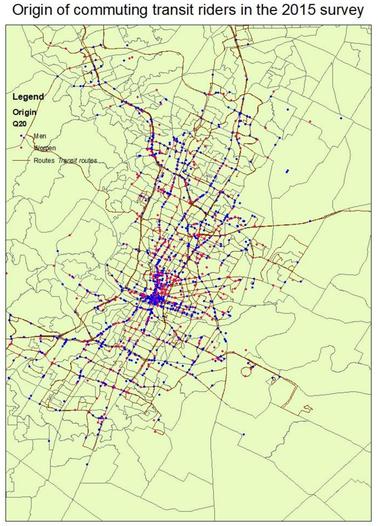
Background

- Urban public transportation systems have multiple goals, but a major one is to serve people with less access to public facilities, such as those who cannot drive or afford automobiles (Lewis & Williams, 2019; Lyons & Ewing, 2021; Sanchez et al., 2004).
- Many studies have shown that women generally have less mobility than men; low-income, carless women are the most disadvantaged group in most urban areas (Metro, 2019).
- Studies have also found that women have travel patterns distinguishable from men; women generate more multi-purpose trips using multiple modes, and their trips are more dispersed geographically and temporally (Daisy et al., 2018).
- Some theories explain the gender disparity in commuting pattern, for example, the household hypothesis, labor market structure hypothesis, and commuting preference hypothesis (Clark et al., 2003; Cao, et al., 2009; Fan, 2017; Reuschke and Houston, 2020).

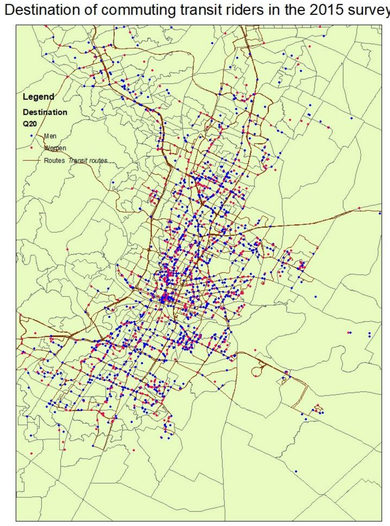
Research Questions

- **Do women have extra commuting burden compared to men, revealed in the commuting distance by public transit?**
- **Do women have more chained trip on their way to/from work?**
- **Does it vary across other factors such as age, income, car ownership and travel time of a day?**

Origin of commuting transit riders in the 2015 survey

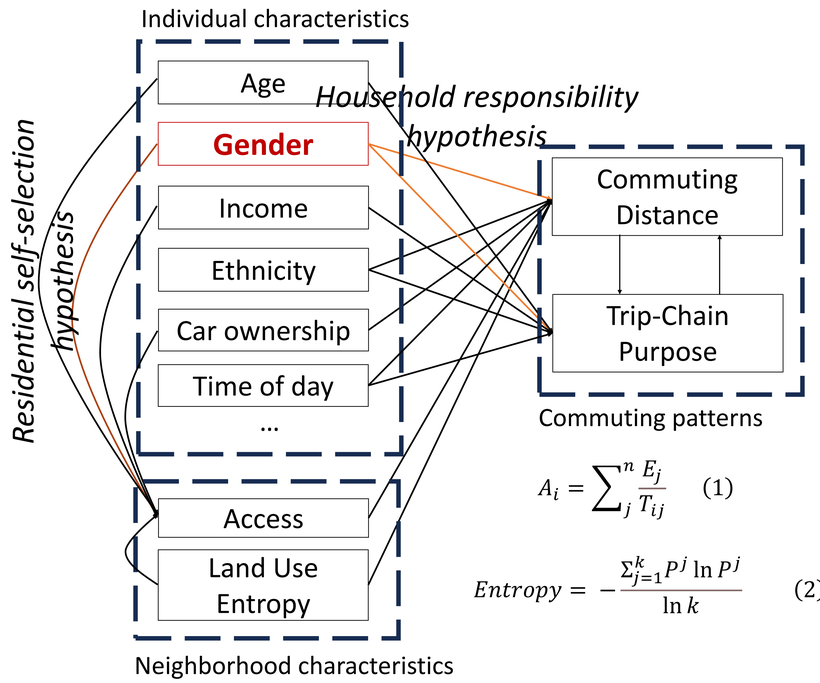


Destination of commuting transit riders in the 2015 survey



Methods and Data

Structural Equation Model (Full Model)



$$A_i = \sum_j^n \frac{E_j}{T_{ij}} \quad (1)$$

$$Entropy = -\frac{\sum_{j=1}^{k} P^j \ln P^j}{\ln k} \quad (2)$$

Table 1: summary statistics of the endogenous and exogenous variables

Variables	Data structure	Description/Measurement	Mean	Var.
Endogenous variables				
Commuting distance by transit	Numerical	Log of the Euclidean distance between reported origin and destination of this trip	10.034	1.246
Multi-purposes of a commuting trip	Categorical	Reference group: Home to work (single purpose)	0	0
		Factor 1: Home to work to school (trip-chain)	0.023	0.022
		Factor 2: Home to work to recreation (trip-chain)	0.085	0.078
Accessibility	Numerical	Formula (1)/10	4.523	0.566
Land use entropy	Numerical	Formula (2)	0.573	0.121
Exogenous variables-individual/trip attributes				
Age	Numerical	Log of the age of the respondent	3.469	0.121
Gender	Categorical	0: Men; 1: Women	0.40	
Race	Categorical	Reference group (0): White/Angelo	-	-
		Factor 1: African American; Factor 2: Asian		
		Factor 3: Hispanic; Factor 4: All other		
Income	Ordinal	Monthly income earned by respondent	1.16	
		0: $0-$2000; 1: $2000-$4000; 2: $4000-$6000; 3: >$6000		
Household size	Ordinal	Number of people in the household	0.21	
		0: one person; 1: more than one person in the household		
Car ownership	Ordinal	Number of cars in the household	0.47	
		0: zero car; 1: at least one car per household		
Time period	Categorical	Time of the day for this trip. Reference group: Midday	0	0
		Factor 1: AM hours	0.221	0.172
		Factor 2: PM hours	0.302	0.211
		Factor 3: late evening and night	0.138	0.119

Results

Reduced Model and the coefficients (after model comparison)

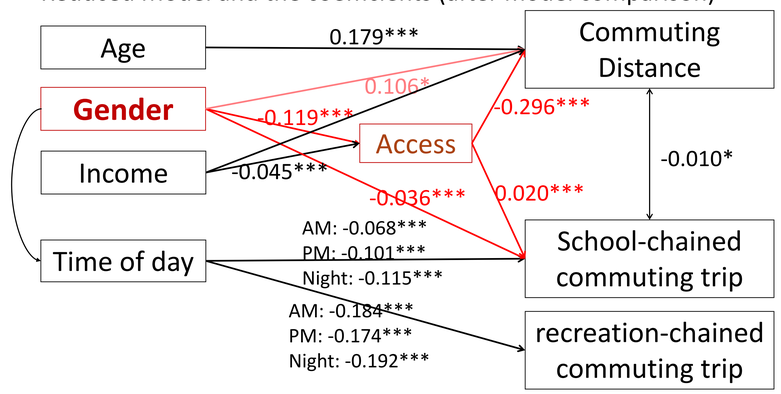


Table 2: Model Results of the Path Analysis

Overall model performance			
Model Test User Model:		**Comparative Fit Index (CFI)**	0.99
Test statistic	16.778	**Akaike (AIC)**	6103.15
Degrees of freedom	14	**Bayesian (BIC)**	6223.698
P-value (Chi-square)	0.268	**Root Mean Square Error of Approximation:**	
Model Test Baseline Model:		**RMSEA**	0.013
Test statistic	309.916	**P-value RMSEA <= 0.05**	1
Degrees of freedom	34		
P-value	0	**SRMR**	0.012

Conclusions

- **Gender has more indirect effects on commuting patterns by transit depending on the accessibility of the neighborhood they live. Better accessibility is associated with short commuting distances by transit and more school-chained trips.**
- **Before controlling the accessibility of the neighborhood, women, on average, commute shorter by transit. However, with the residential self-selection effect, the gender disparity becomes less significant in transit commuting distance.**
- **Both gender and income are strong residential self-selection factors on transit commuting patterns. Women, who took transit to commuting, live in less accessible regions than men. Higher-income transit users live in less accessible regions than lower-income users, which can be interpreted as a "choice rider" behavior.**
- **Most trip-chain by transit are in the midday compared to the AM, PM rush hours, and night. Women do not have a significant difference in recreational-chained commuting trips by transit but have significantly fewer school-chained commuting trips.**