Mind for mass transit

Commuters' assessment of public transport as a "reasonable" option

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ABSTRACT

- This study makes use of a **detailed travel-behavior survey** conducted at McGill University in **Montreal, Quebec**, to answer two key questions:

  (1) What **factors influence travelers' perception of public transport** as a reasonable commuting option?

  (2) From those that do consider public transport to be reasonable, **what factors influence their final decision to use public transport?**

Key Findings include:

- There exists a disconnect between the factors that influence a person's initial assessment of reasonableness and subsequent mode choice.
- There may be a sizeable contingent of travelers who consider public transport to be a viable option but nonetheless decline to use it. They may prove an easier target for conversion efforts.

CONTEXT

- Public transport ridership—especially on buses—has recently declined in most North American regions
- To shift travelers to more sustainable modes requires a deep understanding of the factors that influence mode choice, such as population density, accessibility, income, service characteristics, and built environment and land use; in addition to attitudes and behavior.
- This study allows us to directly explore travelers' rationales for selecting a particular mode
- At the individual level, mode choice is essentially a two-step process:

  (1) to assemble a range of reasonable potential modes for the trip;
  (2) to select the preferred mode based on the same set of constraints (time, cost, and benefits) and personal preferences. It is at this stage where expected satisfaction plays its greatest role.

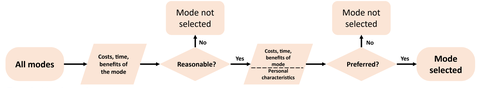


Fig. 1 Mode-selection process

DATA

- Individual commuters' data derived from the 2017/18 McGill University Travel Survey. All McGill staff and faculty and a random sample of 1/3 of the student population received e-mail invitations to complete the survey online.
- 16,930 invitations in 2 waves, in fall and winter. We received 4,850 responses. Excluded respondents with home addresses that could not be geolocated, commuters using highly infrequent travel modes, and participants with incomplete responses leaving 2,758 records for analysis.
- Google's Distance Matrix API to compute travel distances and projected travel times by various modes for the home-to-McGill University trip for each respondent.
- Key Questions for survey respondents:
  - → WALKING is a reasonable option for me to commute to McGill;
  - → CYCLING is a reasonable option for me to commute to McGill;
  - → PUBLIC TRANSPORT is a reasonable option for me to commute to McGill;
  - → DRIVING is a reasonable option to commute for me to McGill

METHODOLOGY

Multi-step Process

(1) Determined which factors influenced survey respondents' perception of the reasonableness of public transport as a commuting option using a logistic regression model with the variable "transit is a reasonable option for my commute" and individual, home selection and neighborhood characteristics as explanatory variables.

(2) Identified the factors that influenced whether the subset of commuters who considered public transport to be reasonable actually used it.

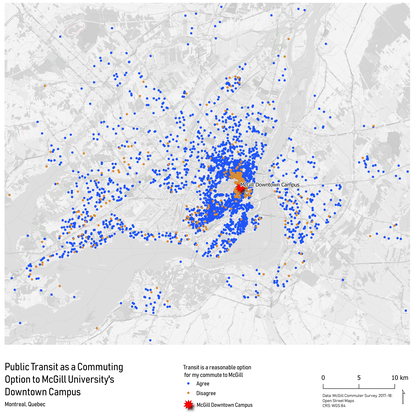
(3) Dedicated special attention to "**swing**" **commuters**—people who considered both driving and public transport to be reasonable.

Modeling Algorithms

- Used multilevel models to reduce spatial estimation bias
- Tried penalized quasi-likelihood method and the Gaussian Hermite quadrature method (QUAD) with similar results; retained QUAD, more appropriate for clusters with few observations and for binary-outcome variables
- For "**swing**" commuters, we analyzed mode-choice determinants for this subset of interest using a generalized linear model without random effects

RESULTS

Public transit as a commuter option to McGill



Multi-Level Logistic Regressions for Public Transport Reasonableness and Subsequent Transit Mode Choice Among Those Who Consider It Reasonable

	Transit is a Reasonable Option to Commute to McGill		Transit is a Reasonable Option and Was Main Mode for Last Trip to McGill	
Predictors	*Odds Ratios*	*CI*	*Odds Ratios*	*CI*
Individual variables				
Age	0.995	0.9834 – 1.0067	0.9926	0.9837 – 1.0015
Children 16 years or younger	1.0824	0.8817 – 1.3288	0.8589 **	0.7476 – 0.9869
Sex (male =1)	1.1579	0.8707 – 1.5398	0.5635 ***	0.4518 – 0.7027
Own a car	1.4250 *	0.9355 – 2.1705	0.5743 ***	0.4378 – 0.7532
Home-location variables				
Road-network distance (km)	0.9776 *	0.9557 – 1.0001	1.2501 ***	1.1964 – 1.3061
Road-network distance squared (km)			0.9964 ***	0.9954 – 0.9973
Home-selection variables (important = 1)				
Being near to McGill	0.802	0.5484 – 1.1728	0.6194 ***	0.4809 – 0.7979
Being near to amenities	0.8625	0.5849 – 1.2720	0.5280 ***	0.3663 – 0.7611
Being near to public transportation	3.7966 ***	2.7639 – 5.2152	5.8295 ***	3.8581 – 8.8084
Being near to bicycle infrastructure			0.5903 ***	0.4658 – 0.7481
Social safety/low crime			0.7767 *	0.5753 – 1.0487
Traffic safety			0.8102	0.6211 – 1.0567
Being in a place where one doesn't have to drive			1.5126 ***	1.1482 – 1.9927
Typical mode for commuting (reference = Walk)				
Bicycle	2.5394 ***	1.5840 – 4.0711		
Bus	23.2064 ***	10.1162 – 53.2349		
Metro	56.7107 ***	19.9642 – 161.0942		
Commuter train (RTM)	18.6099 ***	7.0235 – 49.3100		
Carpool (car passenger)	1.6373	0.6119 – 4.3811		
Drive (car driver)	0.4936 **	0.2807 – 0.8680		
(Intercept)	1.5624	0.8259 – 2.9557	0.985	0.5553 – 1.7473
Random effects				
σ^2	3.29		3.29	
τ_{00}	0.56 $_{CTUID}$		0.53 $_{CTUID}$	
ICC	0.14		0.14	
N	640 $_{CTUID}$		613 $_{CTUID}$	
Observations	2700		2270	
Marginal R2 / Conditional R2	0.505 / 0.576		0.278 / 0.377	
			* p<0.1 ** p<0.05 *** p<0.01	

Transit mode choice for "swing commuters", who consider both driving and public transport reasonable options

	Transit is a Reasonable Option and Was Main Mode for Last Trip to McGill	
Predictors	*Odds Ratios*	*CI*
Individual variables		
Age	0.9817 **	0.9670 – 0.9965
Children 16 years or younger	0.7522 ***	0.6097 – 0.9280
Sex (male =1)	0.8324	0.5681 – 1.2196
Own a car	0.3881 ***	0.2319 – 0.6494
Home-location variables		
Road-network distance (km)	1.1367 ***	1.0757 – 1.2012
Road-network distance squared (km)	0.9983 ***	0.9973 – 0.9994
Home-selection variables (important = 1)		
Being near to McGill	0.715	0.4680 – 1.0923
Being near to amenities	0.5842 *	0.3314 – 1.0298
Being near to public transportation	5.6624 ***	3.0720 – 10.4372
Being near to bicycle infrastructure	0.6293 **	0.3990 – 0.9925
Social safety/low crime	0.5028 **	0.2683 – 0.9423
Traffic safety	0.7045	0.4432 – 1.1199
Being in a place where one doesn't have to drive	1.9156 ***	1.2110 – 3.0303
(Intercept)	2.1965 *	0.8669 – 5.5657
Observations	603	Observations
Tjur's R^2	0.21	
	* p<0.1 ** p<0.05 *** p<0.01	

Descriptive observations

- 70% of commuters who described public transport as a reasonable option took public transport
- 4% of people who disagreed that transit was a reasonable option rode the bus, metro or commuter rail.
- Many respondents **who disagreed that transit was a reasonable option are collocated** with those who considered transit a reasonable option, indicating that perceptions may derive in large measure from personal considerations beyond neighborhood-level characteristics.

Is it reasonable and do they take it?

- Clear **disconnect appears to exist between stated perception and actual behavior.** Men and car owners, in particular, were more likely to say public transport was a reasonable option but then NOT use it.
- Having **children lowered odds of taking transit**, even after describing public transport as a reasonable option.
- Preoccupation with **social safety** and **crime** were associated with lower odds of public transport ridership on the subset of people who said that public transportation was a reasonable option.
- **Car ownership** correlated with **higher odds of considering** public transport reasonable BUT **car commuting associated with lower odds** of using it

Swing commuters

- 22% of respondents to the survey said that both driving and transit were reasonable options.
- 194 currently use cars as either drivers or passengers for their main mode, representing potential swing commuters who may be at least marginally more susceptible to being shifted to other, more sustainable modes.
- 382 of these swing commuters currently use public transport as their main mode and could potentially be driven to opt for less sustainable modes.

CONCLUSIONS

- **Car ownership** and the **presence of children** in a household is negatively associated with public transport mode choice, suggesting a range of potential policy responses.
- There are **clear gender differences in mode choice**, though there is no statistically significant difference between men and women when it comes to identifying public transport as reasonable.
- **Swing commuters**—those who consider driving and transit to be reasonable options—should be of particular interest to policymakers since they **represent both an opportunity and a risk**: Drivers who think transit is reasonable might be easier targets to convert; but transit users who think driving is reasonable could be at risk for defection.

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