WHO, WHAT, WHEN, AND WHERE

Revisiting the influences of transit mode share

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ABSTRACT

This research seeks to understand how daily fluctuations in transit service are related to ridership in the Greater Toronto and Hamilton Area (GTHA) for different wage groups. Many variables have been linked to transit use in past research, including: frequency and proximity of transit service, socio-economic status, the built environment, and accessibility to employment using transit.

However, many previous studies focus only on travel during peak hours. This study investigates whether temporal fluctuations in service or need are related to transit ridership rates.

Using five time periods, this study produces an improved understanding of daily variations in transit mode share for commuting trips. By further dividing the commuting population into two employment wage categories, we demonstrate that common understandings of the causes of transit ridership are potentially misleading.

INTRODUCTION

Variables typically related to transit mode share can be divided into two main groups: those pertaining to the rider's personal situation (socio-economic and other demographic variables) and those dealing with the activities and connectivity that make up a rider's milieu (the built environment and transit availability).

Socio-Economic

A person's social and economic status can influence their use of transit. In particular, social deprivation has been linked to higher rates of transit ridership. Deprivation is not determined by income alone, but by other factors, including immigration status, unemployment and housing affordability.

Built-Environment

Density, the diversity of land uses, and the urban design of an area can influence transit ridership, even when residential self-selection is controlled for. Also, proximity and frequency of service can influence ridership.

INTRODUCTION, CONT'D

Accessibility's relationship with transit mode share has also been investigated. This measure aims to account for both the access areas have to transit service as well as the opportunities that are reachable using those services. Accessibility measures often make two basic assumptions, which this study avoids.

1 There is an assumption that all opportunities attract equally. However, different opportunities (jobs, for instance) attract different commuters. Dividing the population by wage is one way to understand the different needs of commuters.

2 A second assumption is that accessibility to jobs remains constant over the day or that accessibility during peak travel hours is indicative of a transport system's performance overall. This is clearly not the case regarding most transit services.

METHODOLOGY

We use a series of Ordinary Least Square regressions to explain how fluctuations in job availability and transit service have an influence on transit mode-share at the census tract level in the GTHA. By dividing the working age population into two wage groups, we can see how these variables differ in their influence for these two groups. We focus on two variables:

Socio-Economic Indicator

We use an indicator which equally includes:
- Median income
- Unemployment rate
- Share of residents recently immigrated
- Share of residents paying > 30% of their income on rent

Accessibility

Accessibility is calculated using the gravity-based measure:
- For five time periods
- For our two wage-groups
- For the entire working population

ANALYSIS

Transit mode share over the day:

Low-Wage Workers **Higher-Wage Workers**

Statistical Model:

	6am			7am			8am		
	Total jobs	Low-wage	Higher-wage	Total jobs	Low-wage	Higher-wage	Total jobs	Low-wage	Higher-wage
Transit frequency[a]	0.003	0.035*	-0.005	0.012	0.048**	0.006	0.017*	-0.021	0.023**
In urban core	0.171***	0.078***	0.167***	0.134***	0.175***	0.111***	0.200***	0.217***	0.190***
In inner suburbs	0.120***	0.140***	0.119***	0.123***	0.190***	0.117***	0.154***	0.164***	0.149***
1 km to subway station	0.385**	0.25	0.089	0.254*	-0.002	0.218	0.633***	0.692**	0.498***
1 km to GO station	-0.027	0.447	-0.193	-0.144	0.371	-0.226	-0.04	0.292	-0.054
Distance to highway on-ramp[†]	-0.022**	-0.005	-0.022**	-0.015**	-0.018	-0.013*	-0.003	-0.009	-0.003
Social indicator decile	**0.008*** **	**0.014*** **	**0.010*** **	**0.014*** **	**0.010*** **	**0.015*** **	**0.011*** **	**0.008*** **	**0.013*** **
Mean distance[†]	0.069***	-0.017***	0.049***	0.068***	-0.023***	0.045***	0.020**	-0.007	0.019**
Accessibility to jobs by transit	**0.019*** **	**-0.014**	**0.024*** **	**0.013*** **	**0.013**	**0.015*** **	**0.011*** **	**0.018**	**0.013*** **
Constant	-0.027	-0.019	0.017	-0.077***	-0.001	-0.028*	-0.071***	-0.03	-0.067***
R^2	0.529	0.234	0.463	0.731	0.338	0.674	0.78	0.319	0.753
AIC	-2008.354	-821.513	-1577.426	-2736.932	-696.775	-2379.064	-2771.349	-897.782	-2516.496

	9am to Noon			Noon to 5am		
	Total jobs	Low-wage	Higher-wage	Total jobs	Low-wage	Higher-wage
Transit frequency[a]	0.019	-0.007	0.018	0.029**	0.041**	
In urban core	0.198***	0.191***	0.179***	0.206***	0.273***	0.183***
In inner suburbs	0.165***	0.165***	0.156***	0.192***	0.243***	0.170***
1 km to subway station	0.299*	0.035	0.181	-0.017	-0.603**	0.231
1 km to GO station	0.11	-0.787*	0.387	0.185	0.196	0.235
Distance to highway on-ramp[†]	0.003	0.008	0.002	0.001	-0.005	-0.006
Social indicator decile	**0.018*** **	**0.019*** **	**0.018*** **	**0.014*** **	**0.020*** **	**0.013*** **
Mean distance[†]	0.011	-0.018***	0	0.008	-0.018***	0.018
Accessibility to jobs by transit	**0.011*** **	**0.015**	**0.015*** **	**0.017*** **	**-0.002**	**0.033*** **
Constant	-0.053**	-0.046**	-0.028	-0.018	0.001	-0.008
R^2	0.639	0.304	0.556	0.684	0.457	0.57
AIC	-2037.444	-601.848	-1571.55	-2108.392	-865.694	-1489.261

* p<0.05
**p<0.01
***p<0.001
† Variable/10
[a]: Accessibility /10,000
[b]: Frequency/1,000

1 Separating the population by wage (using $16.00 an hour as a cut-off) leads to a better fitting model compared to a model including the entire working population (compare AIC).

2 Low-wage workers are less likely than higher-wage workers to take transit because of lengthy distances between their home and work locations.

3 Accessibility is positively related to transit mode share for higher-wage workers, but never for low-wage workers.

4 Low-wage workers have the highest transit mode share in the evening. Higher-wage workers experience their peak in the early morning.

5 Also, higher-wage worker transit mode share is more difuse throughout the area, whereas lower-wage transit mode share is heavily concentrated in the center of the region.

6 Residing in a more socially deprived area is positively related to transit mode share, at all times, for both high and low wage workers.

CONCLUSION

Different Needs

By dividing the population into two wage groups, we notice that each wage group has significant differences regarding their transit mode share, and what may influence their mode share.

Targeted Planning

Knowing who needs transit, when they need it, and where they need to go can allow agencies to target projects and improvements.

Captive riders

Low-wage worker transit mode share is not influenced by accessibility. This may indicate that they take transit even when it is not convenient.

Evening Service

Low-wage workers' reliance on transit may explain why their highest level of transit mode share is in the evening (when transit service is not at its peak). Providing more service at this time would improve the level of service experienced by this population.

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