Out of Service:

ABSTRACT

- Shrinking bus ridership noted over past few years. 0
- Study aims at isolating the impacts of internal and external factors on each bus route through a longitudinal analysis of bus ridership.
- Findings suggest increasing number of daily trips and 0 the average route speed keys to bus ridership gains; increase in bus stop spacing decreases bus ridership.
- Reducing service frequency along parallel route will lead to an increase in ridership along the main route.

CONTEXT

- O Bus ridership traditionally has been majority of overall public transport ridership; metro ridership has reached parity more recently due to its growth and declines in bus ridership.
- Montreal transit authority operated a declining 0 number of bus trips between 2012 and 2015, with a slightl increase between 2016 and 2017.
- The decline in bus ridership from 2012 to 2017 varies across the city. Not all routes lost ridership.

STM Service Statistics, 2012 - 2017

Year	Bus Ridership	Metro Ridership	Daily Bus Trips	Total Bus Fleet	Maintenance Rate (%)	Available Bus Fleet	
 2012	257,298,797	155,301,203	19,370	1,712	16.3	1,433	
2013	258,232,718	158,267,282	18,730	1,746	18.0	1,432	
2014	249,955,832	167,244,168	17,923	1,721	20.5	1,368	
2015	233,886,129	179,413,871	17,788	1,721	21.6	1,349	
2016	225,734,114	190,465,886	17,852	1,771	19.3	1,411	
2017	222 610 236	206 889 764	18 170	1 837	21.1	1 449	



Data sources for ridership, demographic, operational, and contextual data were acquired to represent service variables.

Ridership Data

Annual ridership for each bus route between 2012 and 2017

Operational Data

Contextual Data

Annual Average Route Characteristics

Internal Variable Annual ridersh Average wee Neekday he Route length (Route averag Route stops Route stop spo Route is expre Route connects Route does no Route is 10 Mi Route is in BIX Cash fare (\$) Monthly fare (Buses removed Parallel route Parallel routes

Identifying Route-level Determinants of Bus Ridership Over Time in Montreal, Quebec, Canada

DATA

183 routes; a separate case was generated for each year from 2012 - 2017, resulting in a sample of 1,098 observations.

STM operating data were retrieved from archived General Transit Feed Specification (GTFS) datasets for all years that are available online.

• Demographic and socioeconomic data were retrieved at the census tract level from Statistics Canada for both 2011 and 2016, including each year's Census data and commuting flows data.

• Several contextual variables were generated for inclusion in the models, including the average price of gas for the Montréal region retrieved from Statistics Canada. RHs are included as dummy variables, with Uber selected as the dominant ride sharing company and BIXI for the bicycle sharing company.

Variable name	2012	2013	2014	2015	2016	2017
es						
nip	1,421,540	1,426,700	1,380,971	1,292,189	1,247,150	1,223,133
ıy trips	107.02	103.48	99.02	98.28	98.63	99.84
kday travel time (min)	34.35	34.55	34.74	35.23	35.46	35.92
adway (min)	26.29	26.07	26.63	26.95	26.77	26.69
ak travel time (min)	35.23	35.49	35.81	36.56	36.71	36.51
ak headway (min)	24.98	25.41	25.77	26.15	26.17	23.21
adway standard deviation (min)	17.37	17.8	17.15	17.55	16.85	18.03
km)	11.68	11.79	11.74	12.55	12.32	12.49
e speed (km/h)	20.45	20.12	19.95	20.92	20.75	20.55
	36.22	36.22	36.22	36.27	36.29	36.33
acing (m)	406.99	400.45	383.65	426.27	425.06	413.69
ess (%)	18.68	18.68	18.68	18.68	18.68	18.68
s to EXO (%)	11.54	11.54	11.54	11.54	11.54	11.54
ot connect to Metro (%)	13.19	13.19	13.19	13.19	13.19	13.19
inutes or Less (%)	17.03	17.03	17.03	17.03	17.03	17.03
l service area (%)	26.37	26.37	26.37	26.37	26.37	26.37
	3	3	3	3.25	3.25	3.25
(\$)	75.5	77	79.5	82	82	83
d for maintenance (%)	16.3	18	20.5	21.6	19.3	21.1
S	16.02	16.02	16.02	16.02	16.02	15.93
s with a cut in trips	-	7.73	9.94	11.60	6.08	3.30

RESULTS

STM Bus Ridership & Daily Bus Trips, 2012 - 2017





Key Findings

- significant positive impact on ridership.
- significant negative effect on ridership.
- result in a 0.1% loss to annual ridership.
- ridership.

Nick Chaloux¹, Ahmed El-Geneidy², & Ehab Diab³ ¹Access Planning, ²McGill University, ³University of Saskatchewan

• The number of daily weekday trips has a statistically

• The number of daily weekday trips has a statistically

Travel time has diminishing returns with an inflection point. For every one minute added to a route travel time, a 2.8% gain in annual ridership is expected. However, every additional travel time minute will

• Service speed has a statistically significant positive impact on ridership. Every 1 km/h of additional route speed results in a 1.00% increase in annual

• For routes competing in a bike-sharing service area, a ridership loss of 21.3% can be expected.

Routes by Ridership Change, 2012 - 2017

Percentile	Change in Ridership	2017 Total Ridership	Change in number of Trips	2016 Medie Income (\$)
Top 5 Routes	291,305	5,100,574	23.0	59,410.8
Top 10%	193,882	22,330,706	7.4	55,682.1
Тор 25%	93,416	41,691,795	5.4	57,675.3
Rest of routes*	-58,952	65,518,311	-3.5	59,696.9
Bottom 25%	-748,765	115,385,707	-25.5	51,956.3
Bottom 10%	-1,427,753	70,737,817	-44.7	49,304.4
Bottom 5 Routes	-2,521,821	23,460,607	-53.2	47,407.7

* Routes from 25% to 75%

Routes by Service Adjustments, 2012 - 2017						
Percentile	Change in number of Trips	2017 Total Ridership	Change in Ridership	2016 Median Income (\$)		
Top 5 Routes	36.0	9,067,092	988,306	55,275.5		
Top 10%	19.7	35,744,098	1,879,612	55,122.7		
Тор 25%	9.4	49,739,231	2,012,931	60,955.2		
Rest of routes*	-3.5	73,690,236	-6,273,697	57,610.0		
Bottom 25%	-29.6	99,166,346	-30,442,218	52,777.4		
Bottom 10%	-48.5	52,659,281	-22,461,838	50,265.9		
Bottom 5 Routes	-71.0	20,507,405	-8,511,091	54,316.2		

* Routes from 25% to 75%

Longitudinal multilevel regression model: annual bus ridership (In)

	All data model		2013 – 2017 data model	
Variable name	Coef.		Coef.	
Route factors				
Daily weekday trips	0.014	***	0.014	***
Daily weekday trips^2	-0.001	***	-0.001	***
Average weekday travel time (min)	0.028	***	0.018	***
Average weekday travel time^2	-0.001	***	-0.001	**
Route average speed (km/h)	0.010	***	0.007	***
Route stops	0.009	***	0.006	***
Route spacing (100m)	-0.013	***	-0.008	***
Route is 10 Minutes or Less (dummy)	0.818	***	0.798	***
Route overlaps with BIXI (dummy)	-0.213	*	-0.250	**
Monthly fare	0.616	***	0.489	***
Monthly fare^2	-0.004	***	-0.003	***
Parallel routes with a cut in trips (dummy)			0.044	***
External factors				
Median household income (\$1,000)	-0.006	***	-0.004	*
Population density (1000/km ²)	0.029	***	0.028	**
Households paying 30% or more (1000)	0.049	***	0.055	***
Average gas price (\$0.10)	0.018	***	0.016	***
Constant	-13.996	***	-8.622	*
Log-likelihoo	d 536.	84	553.0)6
Al	C -1037	7.69	-1070.	12
BIG	C -948	.07	-983.7	7]
ICO	C 0.9	7	0.98	3
Observation	is 1,07	74	898	
Number of group	s 180	0	180)

RAM Transportation Research at McGill

CIRRELT VCGill

CONCLUSION

- O Variables for service quantity and quality, including the number of daily trips and average route speed, are all found to have statistically significant impact on ridership at the route level.
- The relative spatial impact of service changes along parallel routes, which has rarely been explored in the literature, indicates that cutting service frequency for local routes has a statistically significant positive impact on ridership for routes running alongside.
- Findings suggest that the presence of a bike-sharing program such as BIXI has a strong effect on reducing ridership. This is a notable contribution to the literature concerning the integration of bicycle share programs with public transport.

Policy Implications

This study can be of use to transit planners and policy-makers who are striving to increase bus ridership, by exloring the factors affecting ridership at the route level, where most of the policies are implemented and where riders actually feel them.



ACKNOWLEDGEMENTS

The authors would like to thank Social Sciences and Humanities Research Council (SSHRC) and the Centre interuniversitaire de recherche sur les réseaux d'entreprise, la logistique et le transport (CIRRELT) for their funding support.

A big thank you to Jason Magder (Montréal Gazette) for securing the original ridership data by route from the Societe de Transport de Montréal (STM) through an Access to Information Act Request. Thanks also to Trent Bonsall for the poster layout.

