
Mode and Carrier Choice in the Quebec City - Windsor Corridor

A Random Parameters Approach

Zachary Patterson

Transport and Mobility Laboratory, EPFL

Outline

1. Purpose and Context
2. The Stated Preference Survey
 - Survey Development
 - Survey Description
3. Modeling, Results and Conclusions

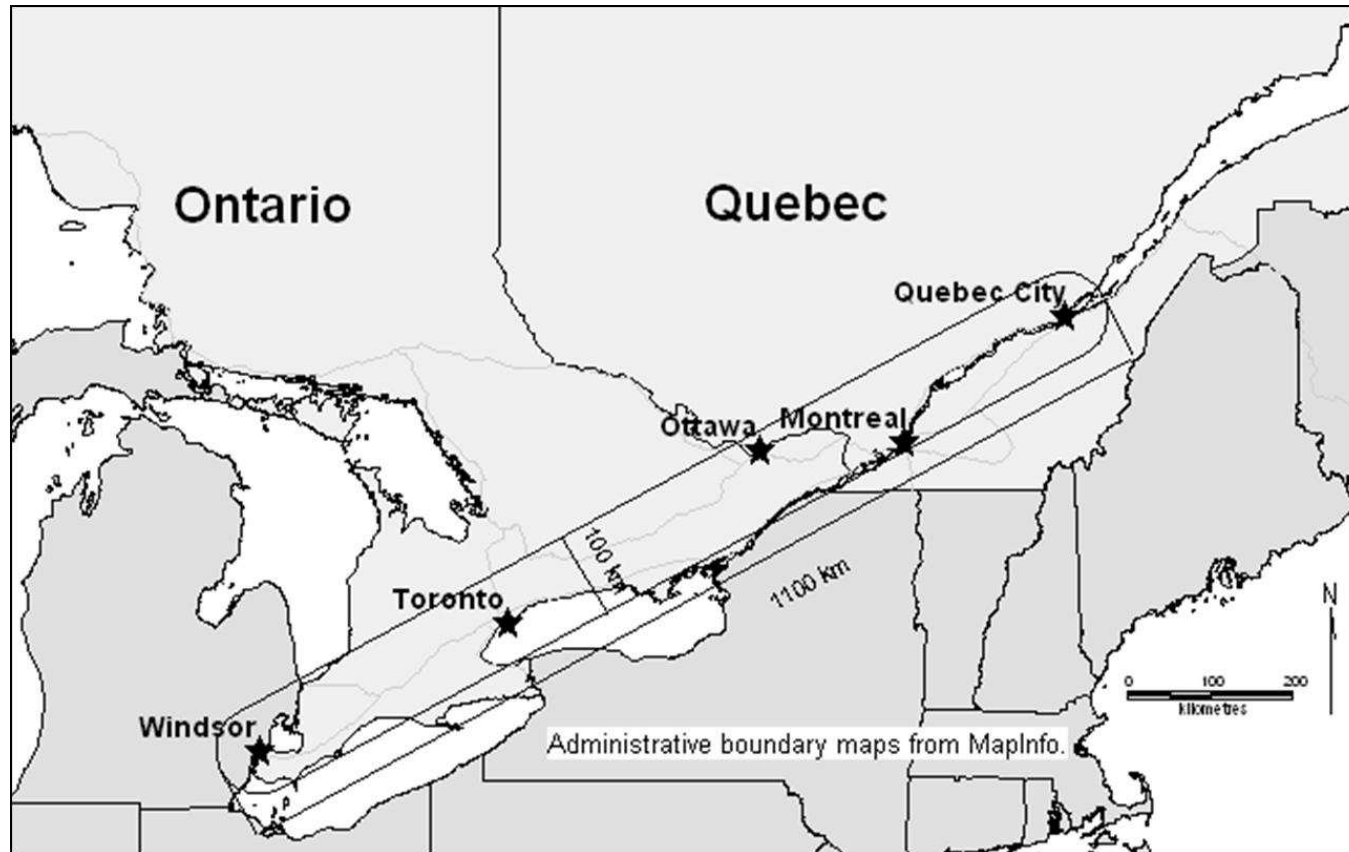
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Freight Transportation in Canada

- Overall freight traffic in Canada is increasing rapidly
- Truck traffic is growing much faster than rail
- Road freight mode split particularly high in the Quebec City - Windsor Corridor
- Road freight traffic is much more GHG intensive than rail
- Can traffic be shifted to rail?
- Quantifiable models of mode choice are needed

The Quebec City - Windsor Corridor



Contestability

- The degree to which traffic can realistically be shifted from one mode to another
- i.e. TRAFFIC is contestable
- Since truck is the benchmark, contestability means...
- ...degree to which traffic can be taken from trucks

‘Standard’ Corridor Service Offerings

- In the Corridor, main intercity destinations have standard, ‘lumpy’ delivery times
 - e.g. Montreal - Toronto overnight
- Moreover, the general pattern of a shipment is:
 1. Pick-up in PM
 2. Delivery in AM
 3. Often the delivery time is ‘by-appointment’
- Competing with trucks means meeting these standards

Realistic Intermodal Options

- Several intermodal options exist (TOFC, COFC, Railcar, etc.)
- Given the exacting characteristics of standard service offerings...
- ...the only current competitive intermodal option is premium-TOFC

Premium-Intermodal

- Late 1990s Canadian Class 1 railways introduce new generation TOFC:
 - scheduled services
 - faster loading times
 - improved ride
- AKA: Smooth-ride Piggyback

Used as the model for premium-intermodal transportation



Previous Freight SP Studies

- There have been several
- They differ in two important ways:
 - survey respondents are:
 - sometimes end-shippers,
 - sometimes end- and own-account shippers
 - sometimes within-, sometimes between-mode surveys

The Concept of End-Shipper

- The important shipping players are:
 - the shipper
 - the carrier
 - the receiver
- They are not mutually exclusive
 - e.g. own-account shippers
- ‘End-shippers’ hire others to carry their shipments

A Shipper Carrier-Choice Model

In understanding use of intermodal:

- Two potentially interesting agents:
 - the shipper
 - the carrier
- Carriers put trailers on trains...
- ...but carriers are constrained by shipper preferences...
- thus a shipper carrier-choice model.

Sampling Frame

Corridor shipping managers of 'end-shippers':


- manufacturers...
- wholesalers and retailers...
- ...with more than 50 employees
- Freight Arrangers (3PLs, etc.)
- Around 7,000 in total

Source: D&B MDDDB

Secondary Research & Pre-interviews

- Literature review → relevant attributes
- Interviews of potential respondents
 - right attributes?
 - enough information?
 - realistic attribute ranges?
- Knowledgeable interviewees invited to focus group

Sample Survey Question

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It is the beginning of your work day. You are responsible for sending a **pallet of mason jars** from **Toronto to Montreal** that is supposed to arrive tomorrow before noon.

Given the characteristics of the carriers, please select which carrier you would choose for this shipment:

Company	Company A	Company C	Company B
Price	\$150	\$165	\$135
On-Time Reliability	98%	85%	92%
Damage Risk	0.75%	1.5%	3%
Security Risk	1%	0.5%	1.5%
How the shipment will be carried	Truck only	Truck only	By rail on a portion of the trip
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Follow these links for more information on [carrier attributes](#), ["by-appointment shipments"](#), or other [shipment attributes](#).

Next

The Intermodal Variable

- Previous studies incorporated mode as an explicit alternative
- Included here as carrier attribute
- Indicates shipment is partly by rail
- Tests whether carriers have opinion about rail
- Unclear what sign to expect:
 - general negative image of rail
 - some saw environmental PR benefit

Survey Implementation

- Telephone marketing firm contracted to:
 - contact and pre-interview potential respondents
 - send respondents survey access information follow-up with non-respondents
- Raffle was offered as incentive
- Roughly 11,000 calls to entire sample
- 392 completed surveys

Standard Conditional Logit

- The MNL is the most common method used to model discrete choice

$$P_{ni} = \frac{e^{\beta' x_{ni}}}{\sum_{j=1}^J e^{\beta' x_{nj}}}$$

Assumes:

- preferences constant across individuals
- errors not correlated across observations

Mixed-logit with Panel Data

- The mixed-logit obviates these limitations
- In the case of panel data:

$$\mathbf{L}_{ni}(\beta) = \prod_{t=1}^T \left[\frac{e^{\beta'_n x_{nit}}}{\sum_{j=1}^J e^{\beta'_n x_{njt}}} \right]$$

- Using simulation methods to integrate over the betas...

$$P_{ni} = \int \mathbf{L}_{ni} f(\beta) d\beta$$

Model Results - Carrier Attributes

Variable	Mixed Logit	MNL
Cost(ln)	-4.72	-3.83
On-time Reliability	0.120	0.10
Damage Risk	-0.44	-0.37
Security Risk	-0.17	-0.14
Intermodal	-1.15	-0.83
Std. Dev. Intermodal	1.34	
Final LLF	-4339	-4660
All coefficients significant at 5%		

Estimated with BIOGEME

Model Results - Shipper Characteristics

- 3PLs less sensitive to damage risk
- 3PLs are less sensitive to cost for high-value goods
- Larger companies more sensitive to on-time reliability

Model Results - Shipment Characteristics

	Sensitivity to:			
	Cost	Reliability	Damage	Train
High-value	-			
By-appointment	-	+		
Perishable		+		
Fragile			+	
Long	+	-		-
All coefficients significant at 5%				

Conclusions

In understanding freight mode choice:

- end-shippers need to be considered apart from other shippers
- shipment distance affects choice characteristics
- innovative method to evaluate mode preferences
- benefits from random parameter approach

With respect to shipment mode:

- strong **bias** against **intermodal** carriers on average
 - a **challenge** for **increasing** rail mode share
- **but** 20% not negatively affected by rail