

Mode and Carrier Choice in the Quebec City - Windsor Corridor: A Random Parameters Approach

Zachary Patterson¹ Gordon Ewing² Murtaza Haider³

¹Ecole polytechnique fédérale de Lausanne, Transport and Mobility Laboratory

²McGill University, Department of Geography

³Ryerson University, Faculty of Business

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Outline

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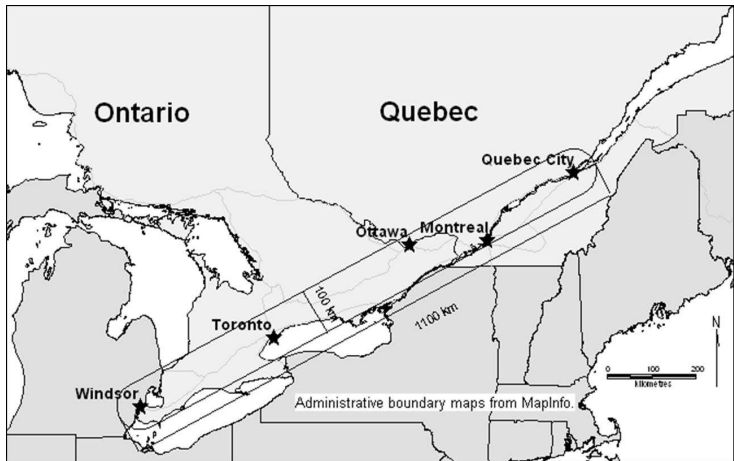
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Freight Transportation in Canada

- 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

- Intermodal means transportation by more than one mode
- 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



Stated Preference Methods

- AKA: Choice Based Conjoint surveys
- respondents choose between hypothetical (but realistic) alternatives
- alternative attribute values from experimental design
- results analyzed using discrete choice methods

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
- We refer to shippers who do not carry their own shipments as 'End-shippers'

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 MDDB

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

Survey Construction

- Web based survey
- SSI Web
 - web-based questionnaire development
 - factorial design
- Preliminary version, pre-tested
- Survey finalized

Sample Survey Question



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

- 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...

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

Carrier Attributes

Variable	Coefficient	Exp(b)
Cost(ln)	-4.72	
On-time Reliability	0.120	1.13
Damage Risk	-0.44	0.64
Security Risk	-0.17	0.84
Intermodal	-1.15	0.32
Std. Deviation	1.34	

Estimated using BIOGEME by Michel Bierlaire of the EPFL

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

Shipment Characteristics

	Sensitivity to:			
	Cost	Reliability	Damage	Train
High-value	-			
By-appointment	-	+		
Perishable		+		
Fragile			+	
Long	+	-		-

Conclusions

Carrier choice is influenced by:

- carrier attributes in ways consistent with theory & previous findings
- shipment characteristics in ways consistent with theory
- shipper characteristics are important determinants of carrier choice

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