Is Carrier Choice Different for 3PLs and other End-shippers? Some Preliminary Findings

Zachary Patterson\textsuperscript{1}  Gordon Ewing\textsuperscript{2}  Murtaza Haider\textsuperscript{3}

\textsuperscript{1}Ecole polytechnique fédérale de Lausanne, Transport and Mobility Laboratory
\textsuperscript{2}McGill University, Department of Geography
\textsuperscript{3}Ryerson University, Faculty of Business

42nd Canadian Transportation Research Forum, 2007
Outline

1. Purpose and Context
2. Methodology
3. Modeling, Results & Conclusions
Acknowledgements

- Transport Canada
- Railway Association of Canada
- Transports Québec
- McGill University
- Le Fonds québécois de la recherche sur la nature et les technologies
For the Quebec City - Windsor Corridor:

- Develop models of shipper choice of carrier;
- estimate the potential to divert freight traffic to rail; and
- estimate changes to CO$_2$ emissions in Canada.
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
3PLs

- Companies that organize logistics on behalf of others
- Increased interest in 3PLs over the past few decades

Existing Literature:

- A lot of interest in the business and academic press
- Research has concentrated on:
  1. degree to which 3PLs are used
  2. reasons for the use of 3PLs
Conclusions about 3PLs

- **Usage common and increasing:**
  - In Canada 40% of companies use 3PLs sometimes
  - In 1991 38% of Fortune 500 companies used 3PLs
  - By 2003 83% used 3PLs

- **Market Potential:**
  - Large (US$ 150 billion)
  - Room for growth (25% of market captured)
Why 3PLs Matter

- If 3PLs exhibit different carrier preferences than other end-shippers...
- ...and are contributing to more traffic...
- ...then understanding their behaviour is important for understanding modal shift
- However, little is known about 3PL carrier choice preferences
A growing mode choice literature exists
Using RP and SP methods
No research looking at 3PLs
This paper tests for differences between 3PLs and other shippers
Methods based on stated preference (SP) surveys
SP surveys ask respondents choose between hypothetical (but realistic) alternatives.
Results analyzed using discrete choice methods.
Discrete Choice Modeling

- Statistical methods applied to choice data.
- Dependent variable takes value of 0 or 1.
- Estimates effect of explanatory variables on choice.
  - e.g. % increase in using rail from decrease in cost
- Most common model - the multinomial logit (MNL).

\[ P_{ni} = \frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \]
QC - Windsor Corridor Shipper Survey

A Stated Preference survey

Goals:

1. Identify and quantify the factors affecting carrier choice
2. Establish the importance of mode in carrier choice
Intermodal Options Competitive with Trucks

- Shifting freight traffic to rail means:
  - Competing with trucks
- Premium-intermodal is the only competitive intermodal option
- It was the ‘model’ intermodal service used for the survey
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
Purpose and Context

Methodology

Modeling, Results & Conclusions

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
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:

<table>
<thead>
<tr>
<th>Company</th>
<th>Company A</th>
<th>Company C</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$150</td>
<td>$165</td>
<td>$135</td>
</tr>
<tr>
<td>On-Time Reliability</td>
<td>93%</td>
<td>83%</td>
<td>92%</td>
</tr>
<tr>
<td>Damage Risk</td>
<td>0.75%</td>
<td>1.5%</td>
<td>3%</td>
</tr>
<tr>
<td>Security Risk</td>
<td>1%</td>
<td>0.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>How the shipment will be carried</td>
<td>Truck only</td>
<td>Truck only</td>
<td>By rail on a portion of the trip</td>
</tr>
</tbody>
</table>

Follow these links for more information on carrier attributes, "by-appointment shipments," or other shipment attributes.
Modeling Approach

- Conditional logit developed for all responses
- Test joint insignificance of 3PL interaction terms
- If test significant...
- ...estimation of separate models for 3PLs and other ‘end-shippers’
## Modeling Results

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>End-shippers</th>
<th>3PLs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price(ln)</strong></td>
<td>-4.54</td>
<td>-3.724</td>
<td>-7.335</td>
</tr>
<tr>
<td><strong>Dist*Price</strong></td>
<td>-0.002</td>
<td>-0.002</td>
<td></td>
</tr>
<tr>
<td><strong>Ontime Reliability (OR)</strong></td>
<td>0.093</td>
<td>0.086</td>
<td>0.100</td>
</tr>
<tr>
<td>*<em>By-appt.<em>OR</em></em></td>
<td>0.046</td>
<td>0.045</td>
<td>0.072</td>
</tr>
<tr>
<td><strong>Damage Risk (DR)</strong></td>
<td>-0.364</td>
<td>-0.378</td>
<td></td>
</tr>
<tr>
<td><strong>Fragile*DR</strong></td>
<td>-0.191</td>
<td>-0.187</td>
<td>-0.511</td>
</tr>
<tr>
<td><strong>Security Risk</strong></td>
<td>-0.100</td>
<td>-0.094</td>
<td></td>
</tr>
<tr>
<td><strong>Intermodal</strong></td>
<td>-0.774</td>
<td>-0.590</td>
<td>-1.189</td>
</tr>
</tbody>
</table>
Carrier choice is influenced by:
- carrier attributes in ways consistent with theory & previous findings
- **strong bias** against **intermodal** carriers

Difference between 3PLs and other end-shippers:
- More price sensitive
- more sensitive to on-time reliability
- almost as sensitive to damage for fragile goods
- even **stronger bias** against **intermodal** carriers

Implications:
- even greater **challenge** for increasing rail mode share
- 3PLs have shippers’ best interests at heart