

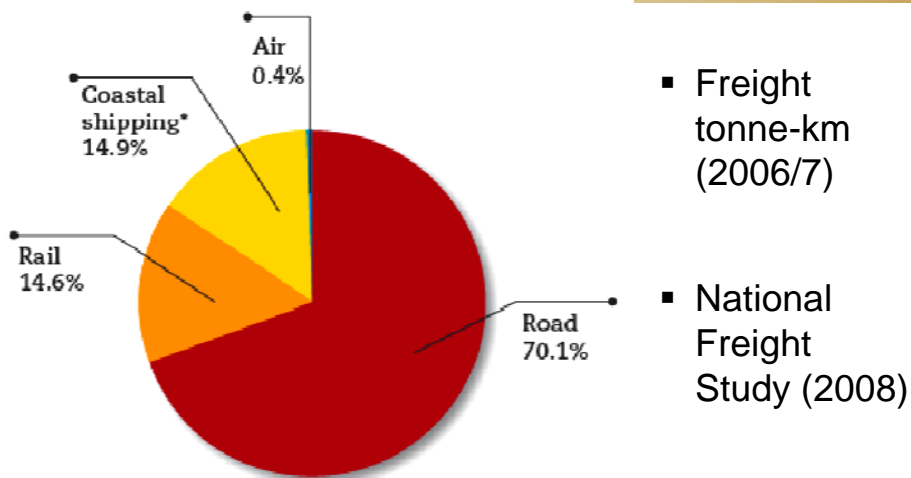
Freight Transport Modal Shift in NZ: Building Understanding of Shippers' Mode Choice

Hyun-Chan Kim, PhD Candidate

Alan Nicholson, Professor



NZ Freight Mode Split



▪ Freight tonne-km (2006/7)

▪ National Freight Study (2008)

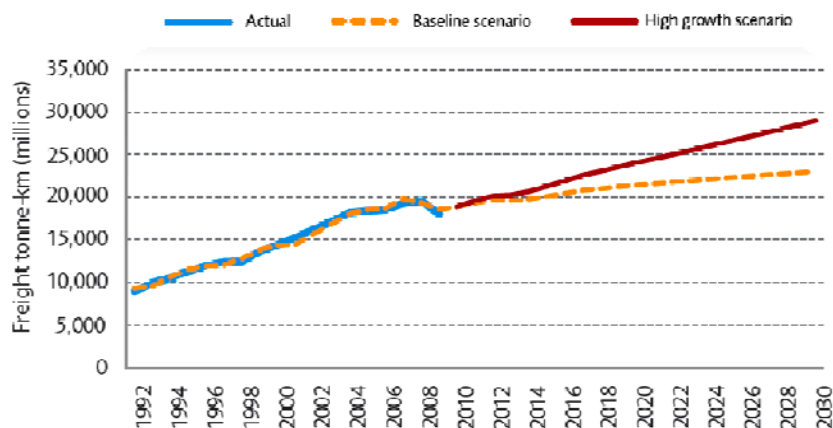
Historical NZ Trends

From 1996 to 2006

- Inflation-adjusted GDP (\$) ↑ 33%
- Freight movement (km) ↑ 44%
- Freight movement (tonne-km) ↑ 55%
- Person travel (passenger-km) ↑ 48%

Transport use (especially freight) growing distinctly faster than GDP.

Projected NZ Trend



Connecting NZ, MOT, 2012

Some questions

Is continuation of business-as-usual sustainable?

Do we need to change our behaviour?

What are the options for change?

Which options are most effective?

Options

1. Trip generation ~ fewer freight movements;
2. Trip distribution ~ shorter movements, more trips in off-peak periods;
3. Mode split ~ more freight moved by rail and/or sea;
4. Trip assignment ~ more trips on designated truck routes.

This study has focused on option 3.

Overseas Actions

Several countries are pursuing shifting freight from road to rail or water (coastal or deep sea shipping, inland waterways):

- EU's Marco Polo programme (€60 m/year);
- UK government fund to support modal shift (£19 m/year);
 - reduce road congestion & reduce emissions;
 - increase efficiency & reliability of freight transport .

- Collaboration important.
- In this study, it was decided to collaborate with shippers, rather than transport industry:
 - included small/medium enterprises;
 - very pleased to be consulted.

Factor Importance

2011 Revealed Preference (RP) survey

- 183 respondents ranked seven factors by importance in constraining shift from road to rail or sea;
- transport time, accessibility, frequency, transport cost, load size, modal transfer, door-to-door;
- ranking varied by sector (primary, manufacturing, wholesale/retail) & mode shift (road-to-rail, road-to-sea);
- respondents provided data about their businesses (export volume, delivery distance, lead-time, etc.);
- rank-ordered logit models estimated.

Analysis of Rankings

FACTOR	RANKINGS										MEAN RANK	RANK ORDER	
	A	B	C	D	E	F	G	H	I	J			
F _A	1	1	1	1	1	1	1	1	1	1	1	1	1
F _B	2	2	2	2	2	2	2	2	2	2	2	2	2
F _C	3	3	3	3	3	3	3	3	3	3	3	3	3
F _A	1	2	1	2	1	2	1	1	1	2	1.4	1	
F _B	2	1	2	1	2	1	2	2	2	1	1.6	2	
F _C	3	3	3	3	3	3	3	3	3	3	3	3	

Rank-order logit model enables assessment of the statistical significance of differences in rankings.

Mode Factors

Importance of factors depends upon the mode shift under consideration.

road to rail

- transport time is main constraint factor, followed by accessibility and loading size;

road to coastal shipping

- accessibility is main constraint factor, followed by transport time and loading size.

Interactions

Importance of factors, & interactions between mode-related & firm-related factors, depend upon the mode shift under consideration:

road to rail

- cost significant if transport distance is short;
- frequency, load size & door-to-door service significant if exports exceed 50%;
- no mode-related variables interact significantly with 'length of contracts with carriers' & (presence of) 'logistics facilities'.

Interactions

road to coastal shipping

- accessibility to port significant if lead time is less than one month;
- frequency and cost significant if firm does not have contracts (with carriers) exceeding three years.

Note: High-level managers seem to place more emphasis on modal transferability and door-to-door capability than low-level managers.

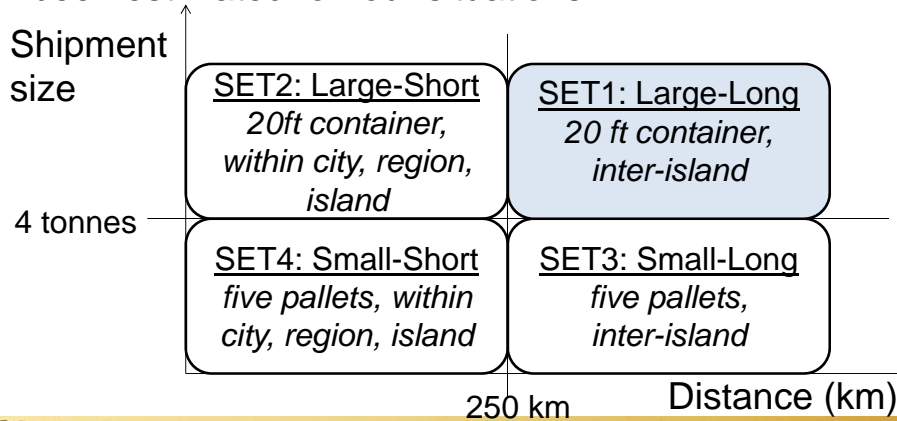
Factor Influence

2012 Stated Preference (SP) survey

- survey design based on RP data, overseas studies and pilot testing;
- 233 respondents considered 18 scenarios;
- mode-related factors (cost, time, reliability, frequency) varied between scenarios;
- respondents indicated which of three modes they would choose in each scenario;
- data about firms (no. of employees, product shelf-life, etc.) also obtained.

Mode Choice Models

Multinomial & mixed logit mode choice models have been estimated for four situations:



Attributes, levels, and corresponding variables

Attribute	Levels		
	Truck (Fixed)	Coastal Shipping	Rail
Cost	\$3766	\$1533~\$2044	\$1897~\$2609
Time	24 hrs	72~96 hrs	36~60 hrs
Reliability	100 %	80~90 %	85~95 %
Frequency	'Anytime'	5~7/week	2~4/day

Mode Choice Models

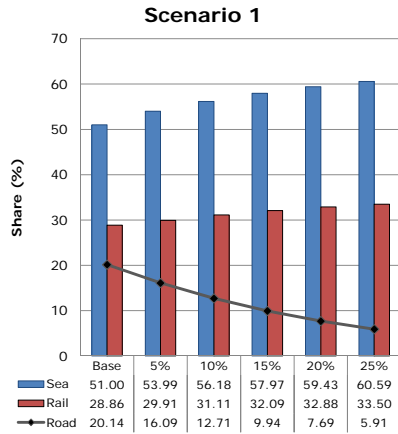
- Mixed logit model fits data better than multinomial logit model (viz. McFadden statistic).
- Three major groups (firms with high exports or longer shelf-life products or located close to a seaport or railway) are distinctly more likely to choose coastal shipping or rail instead of road.
- The highly significant negative 'alternative specific constant' (ASC) for rail and coastal shipping reflects a strong 'bias' towards choosing road transport for freight movements.

Mode Share Estimates

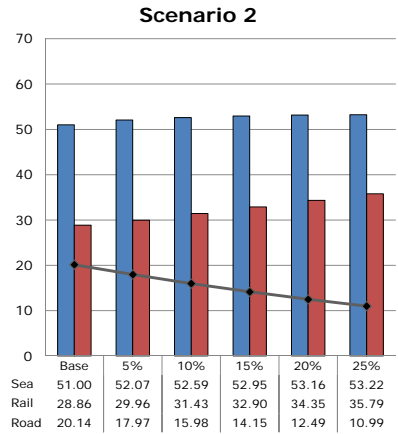
		Road	Coastal Shipping	Rail
Richard Paling Consulting, 2008 (Inter-island)		12.4%	56.8%	30.8%
Rockpoint, 2009 (Auckland – Christchurch)		19.0%	38.0%	43.0%
This study (2012)	MNL model: Inter-island	20.1%	51.0%	28.9%
	ML model: Inter-island	34.2%	44.5%	21.3%

MNL estimates better aligned with others, so used MNL model.

Simulation (Short term policy)

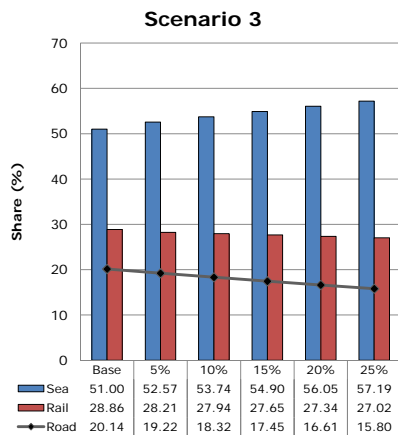


Increase Road Cost

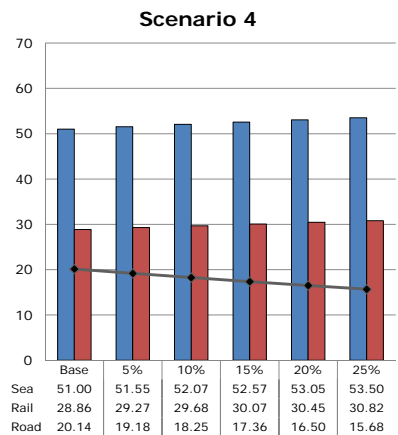


Decrease Coastal shipping & Rail Cost

Simulation (Long term policy)



Decrease Coastal shipping & Rail time



Increase Coastal shipping & Rail reliability

Conclusion

The mode choice models show that for large shipments moving long distances:

- two mode-related factors (cost and time) have a strongly significant influence on shipper mode choice, while reliability and frequency do not;
- all the firm-related factors have a strongly significant influence on shipper mode choice;
- the ASC values indicate a strong 'bias' towards choosing road transport.

Conclusion

Simulating options for shifting freight from road transport to rail or coastal shipping indicate:

- increasing road transport cost has most effect;
- decreasing rail & coastal shipping costs has moderate effect;
- decreasing time or increasing reliability of rail & coastal shipping has least effect.

A 'stick' is more effective than a 'carrot'?

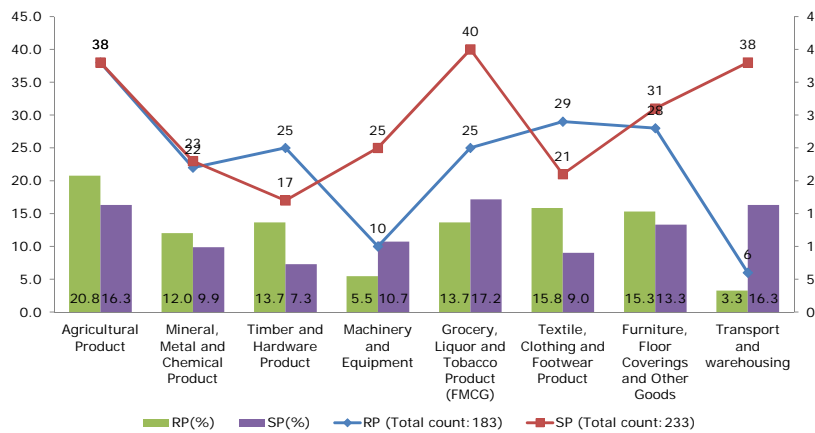
Results here for large shipments & long distances
~ most suited to rail & coastal shipping?

Q & A

Hyun-Chan.Kim@pg.canterbury.ac.nz



Data and sample



Overview of RP and SP Survey Sample by product group*

(*Included transport/freight agents)

In this section, we would like to know how you would react if the transportation modes for your freight were as described below. You will be select one of the three freight transportation options.

The conditions may be very different from what you currently face, they are imaginary. Keep in mind that conditions on your current mode may change in the future.

E1~2: You are responsible for sending a **20 foot container [16 tonnes, 20 m³]** (NZ\$20,000 value of cargo) of products from the nearest warehouse of your company to the customer's warehouse located in **inter-island location** [e.g. Auckland (your firm) --> Christchurch (customer)]. The service provided is **door-to-door**.

Given the characteristics of the carriers, please select which of the following options would you choose for this shipment.

Transport options	By truck	By truck & coastal shipping	By truck & rail
Price(\$ NZ)	\$3766	\$1533	\$1897
Expected Transport Time	24 hours (1 day)	72 hours (3 days)	36 hours (1.5 days)
On-time Reliability* (%)	100 %	80 %	85%
Service Frequency	Anytime	5 per WEEK	2 per DAY

* (Probability of arriving within a given transport time)

By truck By truck & coastal shipping By truck & rail