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Preferences for alternative short sea shipping opportunities

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ABSTRACT

This paper investigates the role of preference and scale heterogeneity in the mode choice process of shippers in the Atlantic Canada–US eastern seaboard market. The generalised mixed logit model is estimated to account for heterogeneity in preferences for frequency of departure of freight transport services, along with heterogeneity in scale across respondents. The contributions of the paper to the literature are: the revelation of significant preference and scale heterogeneity in the sample; the estimated distribution of shippers' willingness-to-pay for gains in service frequency; and the confirmation that there is merit in accounting for scale heterogeneity in future and revisited choice studies.

1. Introduction

This paper builds on previous research by Brooks and Trifts (2008), which examined the mode choice processes of shippers in the Atlantic Canada–US eastern seaboard geographic market. That study built a descriptive model to explain how shippers purchase freight transportation services, and then, using that model, examined how they made choices about allocating freight between service packages in order to predict how they would make choices when faced with a new transport mode—short sea shipping, one which did not exist on the routes examined. As there was no rail option in the corridor, it was a two-mode choice study. This study uses that data to explore further the willingness-to-pay (WTP) for particular choice attributes, using a mixed logit model that accounts for preference and scale heterogeneity (see Fiebig et al., 2009; Greene and Hensher, 2010). The findings of this paper are consistent with the descriptive evidence of Brooks and Trifts (2008) but, critically, extend them by estimating respondents' willingness-to-pay for frequency of service.

As the paper's contribution is to the literature in an area with very few contributions—freight mode choice in a short sea setting, we begin with a review of that literature. Most of the previous transport choice literature on long-distance (or non-urban) transportation activity has focused on choice in the passenger sector (e.g., Hensher, 1997; Hess et al., 2007; Balcombe et al., 2009).

Mode choice has been argued to be a function of distance (Jiang et al., 1999; Paixão and Marlow, 2002; Commonwealth of Australia, 2006), with shorter distances dominated by truck, medium distances dominated by rail and longer ones by shipping, with a contestable market in the intervening zones. Bolis and Maggi (2003) focused on the critical issue of time, a factor of substantial difference between truck and short sea (the slower but usually less expensive option). Therefore, it is important to extend the evaluation of willingness-to-pay within the context of distance captured as a transit time-related variable.

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Previous research in non-urban mode choice in the freight sector has predominantly focused on binary choice models (e.g., Bolis and Maggi, 2003; García-Menéndez et al., 2004). García-Menéndez et al. (2004) identified cost, transit time and frequency as determinants of mode choice in a freight mode choice problem. Investigating a road versus short sea discrete mode choice in Europe, and using personal interviews with freight buyers in four industry sectors, they identified the modal splits for these sectors, and found that shippers' choice of short sea transport is more sensitive to changes in road transport prices than to changes in sea transport costs. Most important, they concluded that imposing an eco-tax on road transport could induce modal switching to short sea. This study is the only antecedent to explore willingness-to-pay.

As an area of transport research, freight mode choice is a complex one to study. Unlike passenger travel, fewer, more sophisticated buyers take decisions, and many of the decisions are either outsourced to third parties or moved under negotiated supply arrangements (Brooks, 1998). This means that a relatively small number of decision-makers can account for a very large volume of shipments, and research costs can be high. Response rates can be low as decision-makers are concerned about competitive intelligence leakage. This is a challenge that Rich et al. (2009) set to solve with a different approach; rather than using stated or revealed preference interviews with the actors making the decisions, they focused on "decoupling agents and shipments" and used ton and commodity data from existing origin–destination matrices to develop a theoretical solution and a value of time result.

We do not find this approach useful in a situation where choice is being tested between an existing mode option and a new (but not-yet-in-service) option. Moreover, their approach is shipment-based. Within supply chains, the same streamlining has occurred; carrier choice today is about choosing suppliers for a contracted period and allocating volume based on negotiated supply arrangements. The single shipment is no longer a valid unit of measurement if investment decisions in new services are to be adequately evaluated for their attractiveness and market adoption. As pointed out by Brooks (1998), very few transportation decisions in North America are transactional in nature as the industry has moved to negotiated supply for transportation services, and supply chains have been reconfigured based on these arrangements. Therefore, discrete choice model focussing on a single shipment is not behaviourally plausible. The Brooks and Trifts (2008) data offers the opportunity to consider choice and willingness-to-pay within a framework of allocation decision-making.

Given the range of attributes driving the short sea mode choice decision, the willingness-to-pay estimates of interest include more than the traditional value of time travel savings but also the value of flexibility in departure schedules and the value of other attributes associated with the mode, not necessarily identified (but perceived to benefit the decision-maker such as reliability) in the choice set offering.

In the next section, we begin by reviewing the Brooks and Trifts (2008) methodology so as to explain the derivation of the data being used. We then develop a choice modelling framework, discussing two approaches—a multinomial logit and a scaled mixed logit model—to explore the decision, identify the model representation with the best fit, before discussing the ramifications of this research.

2. Material and methods

2.1. The Brooks and Trifts (2008) data set

The analysis of the data in Brooks and Trifts (2008), collected in 2006, focussed on a comparison of frequency data across the three corridors considered in the study (i.e., short-, medium- and long-distance travel from Halifax, NS, Canada to three destinations along the US east coast—Boston MA, USA; Philadelphia, PA, USA; and Wilmington, NC, USA, respectively). The comparisons of propensities to utilise different mixtures of freight transport alternatives across corridors revealed useful insights into the nature of shipper preferences. However, the survey captured richer preference information than these comparisons imply. Specifically, respondents made a series of choices exposing a functional relationship between level-of-service mixes and respondents' preferred allocation of freight transport activity across competing alternatives.

The survey questionnaire was administered via internet, and consisted of 15 choice sets, each with two alternatives, gradually including different attributes to a base set of cost and transit time. In the first 12 choice sets, the alternatives were unlabelled (presented as Option A and Option B), whilst the final three choice sets include labels of "truck" and "integrated short sea shipping" for the two alternatives. The 15 choice sets contained five subsets of three choice sets each, representing scenarios in which respondents needed to allocate their preferred proportions of freight transport activity to short-, medium- and long-distance destinations across the two alternatives. The alternatives offered mixes of levels-of-service defined in terms of price, travel time, reliability and frequency of departure; the first choice set for each corridor centred on a restricted trade-off between price and travel time, the next two choice sets for each corridor centred on a trade-off between price, travel time and reliability, and the final two choice sets for each corridor centred on a trade-off between price, travel time and frequency (with reliability at equal levels across alternatives).

Respondents indicated the percentage of their shipping requirements they would allocate to each option on an 11-point scale, labelled so as to allocate cargo in 10% increments. Such an approach recognises that the market reality is that choices are seldom all one or another, but that many companies engage in 'splitting their business among options. A response of 1 indicated a 100% allocation to Option A and a response of 11 indicated a 100% allocation to Option B, with the midpoint of the scale (6) labelled as a 50% split between the two options.