# Analysing freight transport demand using stated preference data: a survey

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*The paper surveys the application of the stated preference technique to analyse freight transport demand. The objective is to identify what is contribution of the hypothetical data analysis to the understanding of freight transport markets, as opposed to the results obtained by using observed, revealed preference data.*

* The paper is the result of a joint effort, though R. Danielis wrote section 1, 2 and 3, and L. Rotaris section 4.

## 1. Introduction*

The objective of this paper is to evaluate the state of the art in the application of stated preference techniques to analyse freight transport demand. Stated preference (SP, hereafter) techniques can be characterised as a "family of techniques which use individual respondents' statements about their preferences in a set of transport options to estimate utility functions. The options are typically descriptions of transport situations or contexts constructed by the researcher" (Kroes and Sheldon, 1988). While there exist recent overviews of application of stated preference methods to passenger transport demand analysis (Hensher, 1994; Polak and Jones, 1997), a review does not exist, to the best of our knowledge, for freight transport. It is recognised that studying freight transport demand poses specific difficulties not faced in passenger transport analysis (Bolis and Maggi, 1998) since:

- freight is heterogeneous;
- modal choice is influenced by the physical characteristics of the goods to be moved;
- freight transport is a derived demand since it is a part of a larger industrial/logistic process;
- more than one decision maker (shipper, freight forwarder, carrier(s), receiver) is usually involved in the decision making process, no one of which has all information and decision power;
- geographic factors (presence of a port or o logistic node) influence transport choices;
- prices are part of a (often long term) contract, shippers are not price takers, and there is little information on prevailing prices.

Given the specific nature of freight transport markets, the paper aims at clarifying what is the contribution which SP-based studies could or did make to the understanding of freight transport demand. Particularly, we want to assess what SP studies could tell us about freight transport demand that could not be captured by traditional revealed preference-based studies (RP, hereafter). Finally, we discuss what issues remained unsolved and what might be the future of SP studies of freight transport demand. The paper is organised as follows. Section 2 recalls the main freight transport models to identify to which modelling framework SP data could be of use. Section 3 compare the pros and cons of SP versus RP data. Section 4 illustrates some SP studies identifying the issues studied, the techniques applied and the results obtained. Section 5 presents a discussion and conclusion.

## 2. Modelling freight transport demand

Freight transport demand modelling has a long history. Mazzarino (1997), in a recent survey of the literature, identifies two main groups of models: macroeconomic and microeconomic models.

Similarly, Winston (1983) subdivides freight transport demand models into aggregate or disaggregate models. The most simple aggregate model is the modal split model where the ratio between the market share of two modes is assumed to depend on differences in prices and in non price attributes (e.g., Boyer, 1977).

A more theoretically-grounded aggregate model is the neoclassical model (e.g., Friedlaender and Spady, 1980) which assumes that a firm is a neoclassical factor price-taking cost minimizer. The firm's demand for transportation by a particular mode results as a derived demand from the cost function, by using the Shepard's lemma. Assuming all firms in a region have the same technology and making use of transport flows data in that region, one can estimate the aggregate freight demand function for that area. In such a demand equation, the market share of one mode typically depends on transport and non-transport prices, the modal attributes and the level of output.

Disaggregate models have the theoretical advantage of being more firmly based on theories of behaviour and to allow for a richer empirical specification. The importance of variables such as shipment size and value can be tested whereas in aggregate models they are obscured in the aggregation process. Obviously, data requirements are more cumbersome since one must collect data on the characteristics of all modes (chosen and unchosen). Two types of disaggregate models have been developed in the literature: behavioural and inventory. A model is termed a behavioural model when it focuses on the mode decisions made by the physical distribution manager of the receiving or shipping firm (Winston, 1981). It is termed an inventory model whenever it comprises also the decisions of the inventory manager, including logistic and production decisions (Baumol and Vinod, 1970; McFadden and Winston, 1981; Abdelwahab e Sargious, 1992; Abdelwahab, 1998). Logistic decisions comprise a large set of (short and medium