Transportation Research Part A 75 (2015) 252–267

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Modelling mode choice for freight transport using advanced choice experiments

Ana Isabel Arencibia [a], María Feo-Valero [b], Leandro García-Menéndez [c], Concepción Román [d,*]

[a] Institute of Tourism and Sustainable Economic Development, University of Las Palmas de Gran Canaria, Spain
[b] Instituto de Economía Internacional, University Jaume I de Castellón, Spain
[c] Instituto de Economía Internacional, University of Valencia, Spain
[d] Institute of Tourism and Sustainable Economic Development, University of Las Palmas GC, Facultad de Economía Empresa y Turismo, módulo D, Campus de Tafira, 35017 Las Palmas G.C., Spain

ARTICLE INFO

Article history:
Received 24 February 2014
Received in revised form 10 February 2015
Accepted 31 March 2015
Available online 15 April 2015

Keywords:
Freight transport
Discrete choice experiments
Stated preference
Willingness to pay
Discrete choice models

ABSTRACT

In this paper we use advanced choice modelling techniques to analyse demand for freight transport in a context of modal choice. To this end, a stated preference (SP) survey was conducted in order to estimate freight shipper preferences for the main attributes that define the service offered by the different transport modes. From a methodological point of view, we focus on two critical issues in the construction of efficient choice experiments. Firstly, in obtaining good quality prior information about the parameters; and secondly, in the improved quality of the experimental data by tailoring a specific efficient design for every respondent in the sample.

With these data, different mixed logit models incorporating panel correlation effects and accounting for systematic and random taste heterogeneity are estimated. For the best model specification we obtain the willingness to pay for improving the level of service and the elasticity of the choice probabilities for the different attributes. Our model provide interesting results that can be used to analyse the potential diversion of traffic from road (the current option) to alternative modes, rail or maritime, as well as to help in the obtaining of the modal distribution of commercial traffic between Spain and the European Union, currently passing through the Pyrenees.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

Even though the current economic crisis is taking some pressure off the saturation of roads, thus relieving traffic in the two main Pyrenean corridors that connect Spain with Europe, it is still of vital importance in the Spanish transport agenda. The very sensitive natural environment through which the traffic flows and the high economic cost of expanding road capacities in mountainous areas make it even more necessary to shift a significant amount of cargo from road to rail and maritime intermodal alternatives. Thus, rebalancing the modal pattern and improving the efficiency of the transport system is paramount in determining the appropriate basis for the Spanish economic growth.

* Corresponding author. Tel.: +34 928 45 17 96.
E-mail addresses: aarencibia@acciones.ulpgc.es (A.I. Arencibia), maria.feo@eco.uji.es (M. Feo-Valero), leandro.garcia@uv.es (L. García-Menéndez), croman@daea.ulpgc.es (C. Román).

http://dx.doi.org/10.1016/j.tra.2015.03.027
0965-8564/© 2015 Elsevier Ltd. All rights reserved.

Road pricing schemes and subsidies to intermodal alternatives, such as the Ecobonus, without a doubt increase the competitiveness of rail and maritime logistics chains. However, the fact that the modal shift objectives set out in the 2001 Transport White Paper (European Commission, 2001) have still not been accomplished indicates the importance given to qualitative aspects of the transport service and the need to further increase the efficiency and quality of intermodal alternatives.

Given the historical trend of the modal distribution for freight transport over the past decades in Spain (characterised by the prevalence of road transport), the compatibility of higher economic growth with sustainable development of the transport system will demand considerable investment by the authorities. However, the urgent need to reconcile investment spending and budgetary stability requires national policy makers to carry out a rigorous assessment of transport projects in order to attain efficient resource allocation. The ability to make investment decisions however will depend on the degree of knowledge of the transport demand as well as on the accuracy with which benefits and costs associated to different actions are quantified.

Thus, an increasing number of agencies incorporate cost-benefit analysis (CBA) in the evaluation of transport projects. Unlike financial analysis, which only takes into account current income and costs incurred by the operator throughout the project, in CBA net social benefits are obtained by comparing benefits and socioeconomic costs of all stakeholders involved in the project. These benefits and costs include both, elements easily quantifiable in monetary terms and elements, such as the value of time, for which there is no direct measurement therefore, making their economic assessment more difficult.

Savings in travel time represents one of the most important benefits derived from infrastructure investments in the case of freight and passenger transport. Despite being the main benefit for the majority of transport projects, researchers have not been able to reach a consensus neither in the magnitude nor in the nature of the value-of-time figures used in project evaluation. The absence of consensus is even higher with regard to freight transport. Indeed, the difficulties associated with obtaining information in this area limit the scope of empirical applications and thereby the methodological debate around the valuation of freight transit time.

As pointed out by Ben-Akiva et al. (2008), the modelling for freight transport demand has evolved significantly over the past decades, from the use of aggregate models based on global data of shippers and shipments, to the use of more sophisticated disaggregated models based on individual data. In this regard, Tavasszy and de Jong (2014), Ben-Akiva et al. (2013), Nuzzolo et al. (2013a) and Chow et al. (2010) provide interesting reviews of the state-of-the-art literature regarding freight transport modelling. In contrast with passenger transport, the use of behavioural models to analyse freight transport demand has been much more limited because of the difficulties associated with data collection. Feo-Valero et al. (2011) identify the most critical issues in freight transport demand modelling; highlighting the identification of the decision-maker, the heterogeneity of the transport flows and the definition of the explanatory variables. Despite these difficulties, the use of freight disaggregate models is increasingly widespread. In this sense, we can cite the work of Bergantino et al. (2013), Masiero and Hensher (2012), Arunotayanun and Polak (2011), Feo et al. (2011), Rich et al. (2009), Polak and Arunotayanun (2009), Bergantino and Bolis (2008), Beuthe and Bouffioux (2008), Brook and Trifts (2008), de Jong and Ben-Akiva (2007), Daniellis and Marcucci (2005), Marcucci and Scaccia (2004), Shinghal and Fowkes (2002), Kurri et al. (2000), Nuzzolo and Russo (1997), and Modenese-Vieira (1992) among the more recent contributions, many of them using stated preference (SP) techniques.

According to the sequential four-step model, transport demand consists in the analysis of four different stages: trip production, trip distribution, modal split and traffic assignment (Ortúzar and Willumsen, 2011). As recognised by de Jong et al. (2012), this structure has been adopted in freight transport modelling with some success, though additional steps are sometimes required in order to transform trade flows, normally expressed in monetary units, into transport vehicle flows. This paper aims to contribute to the field of freight transport demand analysis by estimating a discrete choice model that can be used to analyse the potential diversion of traffic from road to alternative modes, rail or maritime, as well as to help in the obtaining of the modal distribution of commercial traffic between Spain and the European Union, currently passing through the Pyrenees. In particular, the analysis is focused on modelling the third stage of the conventional four-step disaggregate model: the mode choice. This stage is one of most relevant as modal distribution results are among the main factors explaining freight transport externalities (de Jong, 2014a). To this end, a SP survey, based firstly on an orthogonal design and secondly, on an efficient discrete choice experiment, was conducted in order to analyse the freight shipper preferences for the attributes that define the service offered by the different transport modes. From a methodological point of view, we focus on two critical issues in the construction of efficient designs. The first is on obtaining good quality information about the parameters; and, the second, on the improved quality of the experimental data by tailoring a specific efficient design for every respondent in the sample. Extended information on the difficulties linked to the use of tailored efficient designs in the area of freight transport and how the proposed two-step fieldwork copes with them can be found in Feo et al. (2014), where the analysis is focused on the context of modal choice between road and rail in a domestic corridor in Spain. Whereas the advantages of using efficient designs have been widely acknowledged by many authors, not many applications have been focussed on trying to address these two problems together. In fact, this research, together with the work of Feo et al. (2014), is to our knowledge, the only contribution using individual-specific efficient designs in the field of freight transport. Furthermore, the present study is the only one that analyses modal competition at an international level.

Download English Version:

https://daneshyari.com/en/article/310447

Download Persian Version:

https://daneshyari.com/article/310447

Daneshyari.com