



Freight transport analysis: new trends and methodologies. Introduction

Edoardo Marcucci*¹, Sean Puckett²

¹*Department of Public Institutions, Economics and Society, University of Roma Tre, Italy*

²*Institute of Transport and Logistics Studies, University of Sydney, Australia*

1. Editorial

The present special issue is based on papers presented at the Interdepartmental Centre for Research on the Economics of Institutions (CREI) workshop on *Transport choice analysis: models and policy implications* held on November 4th 2009 in Roma Tre University, Faculty of Political Science. CREI was created within the University of Roma Tre to promote the economic analysis of institutions and their decision-making processes, and of national and international public policies. Its main activities include research projects, seminars and conferences, higher education and training, policy advice and consulting. The workshop is one of a series of events organized by CREI in the field of transportation, which is becoming key topic in the array of events promoted.

Many of the authors contributing a paper to the present Special Issue were present at the workshop and others, while not presenting a paper, actively participated. This explanation is essential in clarifying the excellent level of integration among the papers included both in terms of methodological coverage as well as in terms of new trends in urban freight distribution analyzed. Among the guest speakers were Sean M. Puckett from the ITLS at The University of Sydney and Gerard de Jong from ITS at the University of Leeds and Significance.

Once the core papers were identified it was an easy task to invite two specific and well-aimed papers to give the whole project unified form and content. The special issue can be divided in two separate, self-contained, yet interrelated parts.

The first part deals with methodological innovations capable of providing new, potent and interesting tools for studying freight distribution in general and urban freight distribution, in particular. This set of articles deals with the control of scale effects in highly sophisticated and flexible models such as mixed logit models; the use of

experimental economics to study, simulate and, possibly, forecast the intricate and complex interrelations of the various actors cooperating and competing along distribution channels; and the accounting of non-linearities in the estimation of models studying choices of manufacturing firms when deciding which transport service to buy.

The second part discusses the relationship between innovations, both methodological and technological, and specific trends present in urban freight distribution. In particular, this set of papers deals with real-life simulations to provide evidence of the possible results that can be obtained by the deployment of new organisational and methodological innovations in urban freight distribution. These papers illustrate: the most innovative schemes recently introduced in Europe using rail as a distribution mode within cities; a new procedure to estimate the number of trips and the corresponding distances traveled for shopping trips, home delivery and freight point strategies; and a trip chain order model to simulate restocking within urban and metropolitan areas applied to the city of Rome.

The special issue begins with a paper by Puckett, Rose and Bain that departs from the consideration that the current state of practice in the modeling of heterogeneous preferences does not separate the effects of scale from estimated mean and standard deviation preference measures. The generalized multinomial logit (GMNL) model enables the analyst to identify the role that scale plays in impacting estimated sample mean and standard deviation preference measures, including confirming whether the appropriate model form approaches standard cases such as mixed logit. The GMNL model is applied to examine the behavioral implications of the minimum information group inference (MIGI) model within a study of interdependent road freight stakeholders in Sydney, Australia. The results confirm the overall implication that transporters appear to hold relative power over supply chain responses to variable road-user charges. However, the GMNL model identifies a broader range of potential group decision-making outcomes and a restricted set of attributes over which heterogeneity in group influence is found than the mixed logit model. The analysis provides evidence that failing to account for scale heterogeneity may result in inaccurate representations of the bargaining set, and the nature of preference heterogeneity, in general.

De Jong's paper on the relationship between experimental economics (EE) and transport in general and logistics in particular clarifies how EE may be useful in the field of transportation. EE is a branch of economics that started in the late 1940s, centering on the use of laboratory experiments in which subjects are induced to behave as economic agents. In fact, employing EE in transport, and especially in analysing freight transport, has considerable appeal. Two major problems freight modellers often encounter are that for each shipment there can be several decision-makers, and that data are scarce. EE helps to solve both problems. It can, in fact, be used to study situations with several interacting players (in a market and/or game-theoretic setting) and provide data on commercial decisions which are usually not available. De Jong illustrates the parts of experimental economic theory that appear most relevant for application in freight transport, focussing on market experiments to search for empirical regularities; providing a review of the past applications; and describing the design of potential future transport and logistics experiments useful in the analysis of institutional settings (cooperation and information exchange) that lead to efficient transport solutions (minimising vehicle kilometres) while avoiding supernormal profits.

The last paper in the first group is by Rotaris, Danielis, Sarman and Marcucci. This paper tests the role that non-linearities might have in explaining the choice of a freight

transport service. A consistent focus in the literature is on how shippers value various characteristics of a transport service by collecting stated preference data and estimating discrete choice models. These studies usually specify the deterministic part of the utility functions as linear in the observed attributes, thus constraining the characteristics of the analyzed transport service to be perfect substitutes; this amounts to an assumption of a constant substitutability ratio, which is inconsistent with standard microeconomic theory that hypothesizes the decreasing marginal productivity of inputs. The paper tests the linearity assumption for the freight rate, travel time, probability of having damaged and lost freight, frequency, flexibility, mode and punctuality on a sample of Italian small- and medium-sized manufacturing enterprises. The analysis shows that the linearity-in-the-attributes assumption should be rejected, and that the marginal impact on the utility-of-profit of the attributes is not constant. Another interesting result obtained relates to the tendency to overestimate the willingness to pay for qualitative attributes when assuming linearly specified models.

Alessandrini, Dele Site, Filippi and Salucci contribute a paper tackling the issue of sustainable urban freight distribution linked to the use of rail for the urban distribution of goods. The authors acknowledge that rail is an under-used mode of transport when it comes to urban freight distribution, while it offers potential as a sustainable transport mode. This hypothesis is confirmed by a few experiences in Europe where innovative freight distribution schemes using rail have been introduced. The general scheme used foresees the use of rail for the urban penetration leg. After consolidation in a centre located outside the urban area, goods are transported by shuttle trains to a centre located inside the central area and from there transferred to low-pollution road vehicles to be distributed to their final destination. The paper provides a review of rail-based schemes recently introduced in European cities. An in-depth assessment is provided of the scheme based on the use of a Multi-Modal Urban Distribution Centre (MUDC). The case study relates to the distribution of seafood in Rome. The environmental and energy benefits obtainable from the shift from the current road-only scheme to the MUDC scheme are estimated in physical and monetary units. An estimate is provided of the optimal incentive to be paid by the government, obtained as the difference between the social costs of the road-only scheme and those of the MUDC scheme. Also, an assessment is provided of the profitability of the scheme from the operators' viewpoint.

The relevant and controversial issue of proximity deliveries versus shopping trips is explored in the paper by Gonzalez-Feliu, Ambrosini and Routhier. The authors propose a modelling framework to complete the recent scientific works on urban goods modelling. In greater detail, they introduce a substitution procedure for estimating the number of trips and the corresponding distances travelled for shopping trips and home delivery. Furthermore, they provide an appraisal of various scenarios so to study how new forms of proximity delivery services impact on overall urban goods movement activity. Departing from polarized situations they introduce more realistic scenarios in order to find a suitable combination of delivery strategies. The authors provide critical comments and discussions with the aim of defining potential recommendations to public authorities for near future actions.

Finally, Nuzzolo, Crisalli and Comi contribute a paper discussing a trip chain order model for simulating retailer restocking within urban and metropolitan areas. The paper is part of a more general modelling system developed by the authors for simulating urban freight demand considering both demand and logistic sub-systems. The former allows us to obtain freight origin-destination (OD) matrices in quantities and deliveries

per transport service type, time period and vehicle type while the latter can produce vehicle OD matrices according to journey characteristics (i.e., number and sequence of delivery points) needed to restock goods within the study area. The tour-based approach aims at reproducing the choice structure of the restocking process and the sequence of delivery points (stops) for vehicle journeys, considering spatial constraints relating to subsequent trips of the same journey. The logistic subsystem of the proposed modelling system can be split in two parts: one defining the trip chain order (i.e. the number of deliveries made during a tour) and the second considering the choice of the stop locations. This specification and calibration of a trip chain order model uses data collected in the city centre of Rome.

This special issue addresses both interesting methodological issues as well as issues relevant to policy. We believe it provides a fair representation of the main topics discussed during the CREI workshop.

With the anticipation that this represents only the first of a long series of CREI meetings dealing with the field of transportation economics in general and freight in particular, we hope to publish further interesting results of these meetings in future editions of European Transport/Trasporti Europei.