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URBAN FREIGHT TRANSPORT MODELLING: AN AGENT-SPECIFIC APPROACH

FrancoAngeli

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A Teresa e Leandro per il loro esempio, amore e sostegno. (E.M.)

A Mariachiara, Camilla e Viola…le mie tre muse. (V.G.)

A Piero e Paola, per il loro costante supporto. (E.V.)

For Filomena, for always being there. (A.S.)

Essentially, all models are wrong, but some are useful (p. 424)

Box, G.E.P., Draper, N.R., (1987),
Empirical Model Building and Response Surfaces,
John Wiley & Sons, New York, NY.

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ASC	Alternative Specific Constant
ATAC	Agenzia del Trasporto Autoferrotranviario del Comune di Roma (Rome's Bus, Tram and Metro Agency)
AVC	Asymptotic Variance-Covariance matrix
CART	Classification And Regression Trees
CH_4	Methane
COVHET	Covariance Heterogeneity
EC	Error Component
Ho.Re.Ca.	Hotel, Restaurant and Catering
ICT	Information and Communication Technologies
IIA	Irrelevance of Independent Alternatives
LC	Latent Class
LPG	Liquid Propane Gas
LTZ	Limited Traffic Zone
L/U	Loading and Unloading
ML	Mixed Logit
MLEC	Mixed Logit with Error Component
MNL	Multinomial Logit
MNLSE	Multinomial Logit interacting attributes with Socio-Economic variables
SC	Supply Chain
SQ	Status Quo
SP	Stated Preference
SRE	Stated Ranking Experiment
UDC	Urban Distribution Centre

UFT	Urban Freight Transport
WTA	Willingness To Accept
WTP	Willingness To Pay

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1. Introduction

This book investigates urban freight transport (UFT) modelling[1]. The study concentrates on developing methods and models for efficient estimation of urban freight distribution policy effects using *stated preference* (SP) techniques. The considerations and results reported are mainly related to a research project, funded by the Italian Ministry of Research, on methods for assessing the efficiency of freight distribution in Rome's Limited Traffic Zone (LTZ).

The general underlying motivation of the research was to define a knowledge framework for forecasting and optimising urban goods movements. In fact, policy interventions, implemented to date in this sector, often produce unsatisfactory results since insufficient attention is paid to behavioural aspects. In particular, the interactions generated by the implemented policies are often overlooked notwithstanding their relevance in determining the final result. The empirical study of relations and interactions among agents within the supply chain (SC) is a key area of study for defining the performance of the system as a whole. The research effort is focused on the

[1] Notwithstanding the present book is the result of a close collaboration among the authors who share the ideas illustrated herein, Edoardo Marcucci materially wrote 1, 5.1, 5.2 and 6; Valerio Gatta 4.2, 4.2.1, 4.2.2, 5, 5.3, 5.3.1, 5.3.2 and 5.3.3; Eva Valeri 3, 3.1, 3.2 and 4.3; Amanda Stathopoulos 2, 2.1, 2.2, 2.3, 2.4, 4, 4.1, 4.1.1, 4.1.2 and 4.1.3.

development of appropriate SP techniques to accurately estimate the effects of the policies implemented.

More in detail, three main objectives are pursued: *i*) estimate the relative importance that various actors involved in UFT (*i.e.* retailers, transport providers and own-account operators) attribute to the main UFT policy variables; *ii*) perform a segmentation analysis to investigate behavioural specificities of different actors, such as acceptance of different freight policies; *iii*) illustrate the contribution that SP methods might offer in assessing *ex-ante* policy acceptability.

From a methodological standpoint an experimental design approach is adopted on the basis of recent developments in the field of SP questionnaire techniques. The UFT policy evaluation process proposed explicitly considers the role each agent-type plays. Indeed, there is evidence that actors involved in UFT have varying propensity to support a given policy depending both on the particular logistic chain they belong to as well as on the role they play within it. In particular, each logistic chain has a specific structure and organisation in terms of the: *i)* number and type of actors involved, *ii)* allocation of decision-making power, *iii)* logistic and economic variables taken into account in the distribution choices. Within each logistic chain, different actors have a different weight in the process of determining the specific freight delivery arrangements and, accordingly, a specific influence regarding remaining logistic and transport variables. In other words, SP surveys allow, analytically and in view of specific policy designs, to quantitatively examine the behavioural aspects involved in UFT. This approach, in line with recent studies, underlines the crucial role agents' decision-making plays in ensuring the success or failure of policy interventions.

The main contributions of the current volume relate to: *i*) preliminary policy attribute definition via stakeholder consultations also linked to attribute level and range definition; *ii*) questionnaire development and administration; *iii*) agent-specific model estimation

with appropriate treatment of heterogeneity, non-linearity and joint heterogeneity and non-linearity in preferences.

The fundamental lesson learned is that there is no one-size-fits-all policy equally impacting all agents. The main weakness of the study is strictly linked to the use of a single case study. This makes generalisations to other contexts difficult. The results obtained indicate that more behavioural analysis is needed in UFT research especially if reliable policy-relevant results are desired.

The book is structured as follows: chapter 2 sets the stage by defining the study context and illustrating the most prominent researches specifically produced in the realm of UFT; chapter 3 reports a detailed account of the various methodological aspects used in the empirical application; chapter 4 describes the survey instrument developed and the data acquired; chapter 5 reports and discusses the econometric results and their policy implications; chapter 6 concludes and illustrates future research endeavours.

2. Context and literature review

This chapter describes the case study context referring to Rome's freight LTZ with its current regulation (section 2.1) and the main elements related to urban freight movements with a specific overview of the: *i)* UFT actors (section 2.2), *ii)* UFT policy measures (section 2.3), and *iii)* state-of-the-art of the modelling issues (section 2.4).

2.1 Description of study area

The study context refers to the LTZ in Rome's historical centre (Figure 1) where restrictions have been put into place since the late eighties. The institution of a formal LTZ in Rome can be dated back to 1989 when a 5 km² area was restricted to non-resident vehicles.

The bans on traffic apply to both passenger and freight vehicles. Access and circulation in the larger pericentral area called "*ZTL Anello Ferroviario*" is prohibited to pre-Euro-1, Euro-1 light and heavy vehicles. Instead, the central area, that is the focus of this study, is characterised by a more detailed legislation. It corresponds to a 4 km² area in the historical centre. Entrance is allowed to the least polluting vehicles (Euro-1 and later) with permission to access