



Modelling the demand for rail in an urban context: some methodological aspects

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Abstract

In the recent years, the reduction of urban road accessibility and the restrictions to urban centres for environmental issues are pushing to investigate freight solutions based on railway use. With respect to this growing interest, few studies have explored methods and models for modelling freight demand for rail in urban context. Therefore, the paper explores this incoming research challenge giving some methodological aspects for rail demand simulation. Subsequently, a recent modelling framework is recalled and some advancements that allow to point out the rail transport alternative are presented.

Keywords: urban freight transport; urban rail distribution; transport service model; urban mode choice.

1 Introduction

The use of railway infrastructures for freight transport in urban areas is rather limited. It has been used in particular areas and time periods, e.g. transportation of some typologies of goods by tram, to satisfy some logistic needs of private firms (BESTUFS, 2001; Lange, 2001; van Binsbergen and Visser, 2001; Behrends, 2011) or for outlet restocking in a congested urban area in which a railway network already exists (Robinson and Mortimer, 2004a and b; Genta et al., 2006; Nuzzolo et al., 2008).

In latest years, these initiatives are on fashion both for the reduction of road accessibility of metropolitan areas for congestion effects, and the implementation of some environmental measures, despite the difficulties of rail transport to be competitive with respect to road transport (Mortimer, 2001; Wiegmans et al., 2010; Alessandrini et al., 2012; Motraghi and Morinov, 2012; Marinov et al., 2013; Browne et al., 2013).

Due to lack of ex-post experiences, project evaluation and effect assessment of new urban rail service systems has to be mainly based on the simulations of future scenarios (using a “what if approach”), computing some effect indicators able to quantify the expected results in terms of internal and external, direct and indirect costs (Nuzzolo and Comi, 2013). Generally, these indicators are obtained from the network performances and impacts forecasted using the procedure reported in Figure 1. Such a procedure requires as input the freight Origin-Destination

(O-D) matrices that assigned to the network allow to obtain link flows. These flows in turn are used as inputs of the other models that, for example, allow determination of pollution emissions, energy consumption, road accidents and so on.

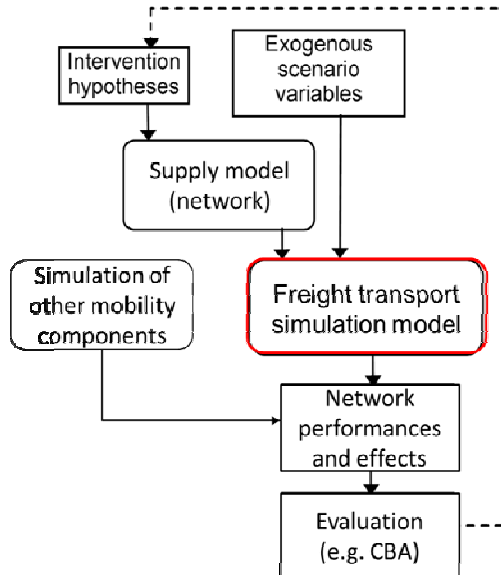


Figure 1 – Project assessment and effect assessment

As pictured in Figure 2, in the simulation model of freight transport, the demand models have to provide as outputs the O-D matrices that assigned to the transport network (both road and road-rail) give us the link flows for project evaluation and effect assessment.

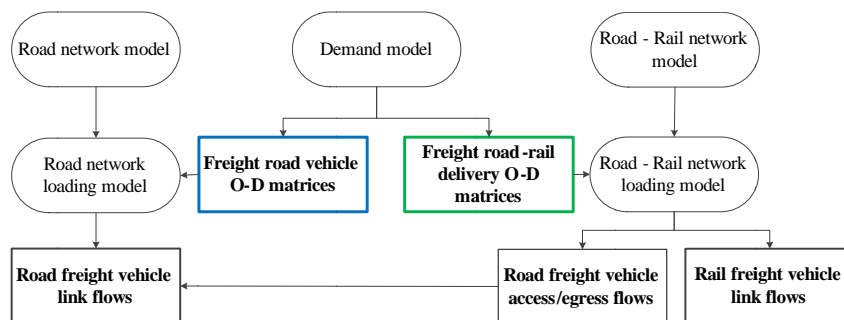


Figure 2 – Freight transport simulation: models and outputs.

It has to be noted that different demand models have to be used for O-D matrix estimation according to possible different temporal scales: strategic, tactical and operational. Referring to freight rail distribution system, if new infrastructures have to be built (strategic long term actions), the models have to consider that the demand of freight within urban areas can change along the time. In fact, as emerged by several surveys (Ibeas et al., 2012), the urban areas are mainly attractors of freight due to satisfaction of the end consumer demand. Therefore, modelling system that allow to point these effects have to be used (Nuzzolo and Comi, 2014a). Similarly, if

we refer to tactical or operational planning horizons (e.g. updating of timetable of existing rail distribution system), the focus is mainly on distribution process, then changes in freight demand due to requests of end consumer can be neglected. This modelling aspect is pointed out in section 4 after that in section 3 the choice dimension and actors which can act deliveries within urban area are identified and analysed showing because probabilistic-behavioural models have to be used.

In this context, the paper seeks to answer to the following questions:

- which are the most suitable demand models to use for urban rail transport analyses and simulations in evaluation procedures that consider short and long terms effects?
- which are the required outputs of the demand model?
- which is the state-of-the-art of urban freight demand models?
- which are the demand models to be developed and of which type?
- which are the modal choice dimensions and the decision makers?
- which type of choice model can be used?
- which type of survey has to be carried out?
- which are the model parameter estimation issues?

The paper starts from analysing the rail service in urban transport systems (section 2), the modal choice dimensions and the decision makers (section 3) and focusing on the main developed demand models (section 4). Then, as modal choice considering rail alternative has been rarely modelled, new demand models are proposed for simulating modal split (section 5) and some indications on data collecting methods are given (section 6). Finally, some conclusions are reported in section 7.

2 Rail service in urban freight transport system

In urban, freight transport is mainly related to the distribution of final products from producers, wholesalers and distribution centres to the businesses (e.g. shops, food-and-drink outlets, offices, firms). In particular, urban distribution can be represented through the functional scheme pictured in Figure 3.

The rail freight system considered, in this paper provides (Figure 4), a connection among at least two rail terminals, where freight transshipment operations from road to railway and vice-versa are performed. One or more terminals (outer terminal) allow the connection between the medium-long distance road freight transport and the rail system; these connection terminals represent points in which all freight that have as final destination (or initial origin) the urban area will be carried from (or to). Other terminals (inner rail stop) are located within the urban area; they allow delivering to destinations in this area. Inner terminals located inside the urban area can also act as Transit Point or Nearby Delivery Area: freight arrives by rail and so it is delivered/picked by low emission light vehicles, adopting strategies providing at optimising delivery/picking tours (Figure 4).

Even if the proposed rail service scheme can be applied in the whole urban freight distribution system, the main relationships that can be interested are the red bold part of Figure 3, that is the case in which the freight passes through a retailer or a food-and-drink outlet before arriving at the end consumer.

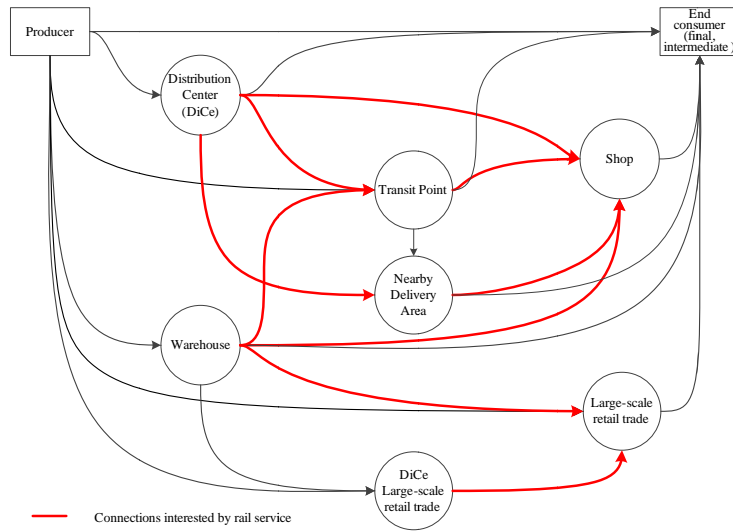


Figure 3 – Urban freight distribution scheme

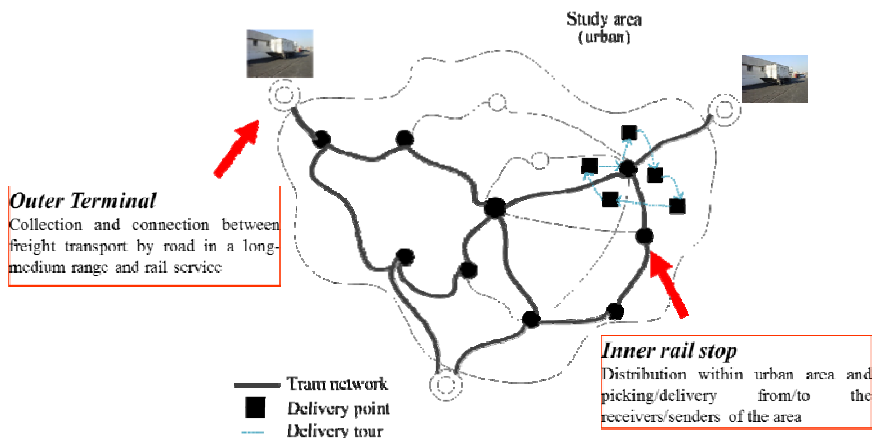


Figure 4 – Rail service structure

The presence of railway transport as alternative to road transport modifies the structure of distribution moving from the one reported in Figure 3 to that pictured in Figure 5.

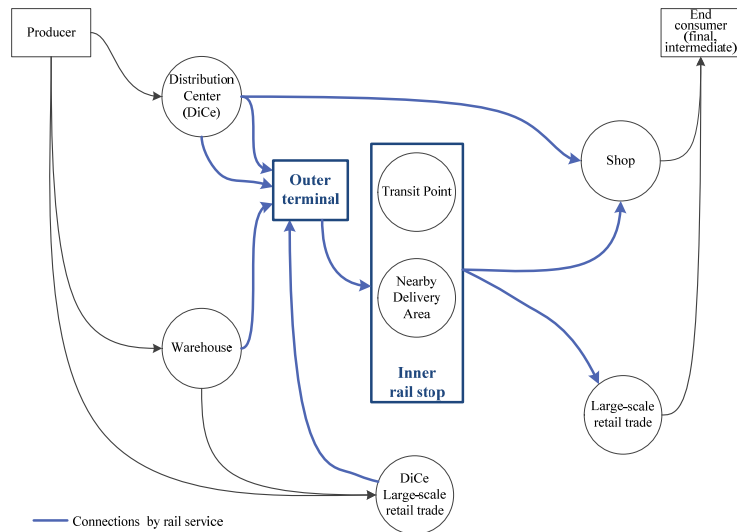


Fig. 5. Freight distribution scheme with rail services

3 Mode choice: choice dimensions and decision makers

The urban freight transport is characterized by different decision makers, which act to move freight. In particular, the involved decisionmakers, which govern the delivery process, are the receivers (e.g. retailer) or the shippers (e.g. wholesaler) and they have to choose if operate on own account or by using service offered by third parties (e.g. carrier). For examples, in Rome (Nuzzolo and Comi, 2015) the 22% of deliveries are governed at destination (i.e. the retailer decides all the stages for moving the freight from warehouses to shop). Table 1 gives the revealed shares according to the different freight types. We can see that:

- beverage, building materials, cloths, electronics, no-fresh foodstuffs, household and hygiene, jewellery, music, pharmaceuticals and cosmetics are generally governed at origin and the 79% come from a zone within the municipality; the restocking flows of these products represent the 53% of whole;
- flowers and home accessories (that represents the 17%) use to be governed at destination and mainly come from restocking zone within the municipality;
- the remaining products are governed with different shares at origin or at destination and come mainly from zones outside the municipality.

Subsequently, each decision makers can choose to use road or road-rail as transport mode, as reported in Figure 6.

Table 1 – Delivery government: shares revealed in the inner area of Rome (Nuzzolo and Comi, 2015)

	at destination	at origin	Total
Beverage	0%	100%	100%
Building materials	0%	100%	100%
Cloths	8%	92%	100%
Electronics	0%	100%	100%
Flowers	100%	0%	100%
Foodstuffs	0%	100%	100%
Fresh foodstuffs	4%	96%	100%
Hardware	72%	28%	100%
Home accessories	98%	2%	100%
Household and hygiene products	10%	90%	100%
Jewelry	0%	100%	100%
Music products	0%	100%	100%
Pharmaceuticals, cosmetics	5%	95%	100%
Stationery products	15%	85%	100%
Other	0%	100%	100%
Average	22%	78%	100%

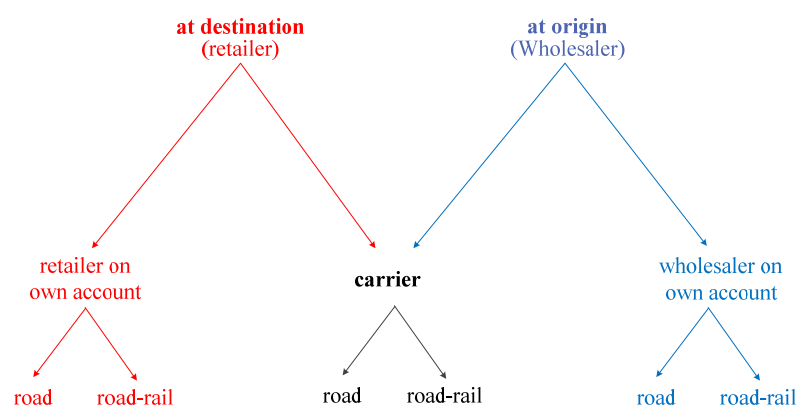


Figure 6 – Choice dimensions: transport service type and mode.

Therefore, freight modal choice with road and rail alternatives has two choice dimensions (type of service and mode) and three decisionmakers (i.e. retailers in own account, wholesaler in own account and carriers). Even if, in principle, the modal choice could be modelled alone, it is better to model together the two choice dimensions, as modal choice is strongly influenced by type of service choice, as detailed in the following.

4 Urban freight demand modelling: a state of the art

Urban freight flows are mainly generated to satisfy the end consumer demand for commodity and services. Then, the urban freight mobility should be considered as composed by two segments (i.e. freight distribution and shopping trip) and should be jointly analysed as components of the same system (Russo and Comi, 2010; Gonzalez-Feliu et al., 2010; Browne et al., 2012; Comi and Nuzzolo, 2014), in particular for long term demand forecasting.

Although several urban freight demand models have been proposed (see for a state of art Ambrosini et al., 2008; Gonzalez-Feliu and Routhier, 2012; Anand et al., 2012; Nuzzolo et al., 2013), few of them have considered joint modelling frameworks that explicitly consider restocking flows as being generated to satisfy end-consumer demand (Oppenheim, 1994; Russo and Comi, 2010; Crocco et al., 2010; Gonzalez-Feliu et al., 2012; Barone et al., 2014a). Besides, very few of them have considered that changes in shopping attitudes or actions impacting on purchasing behaviour of end consumers (e.g. location of shopping zone, transport mode to use for shopping) can also affect restocking mobility (Miodonski and Kawamura, 2012; Sanchez-Diaz et al., 2013). This shows that further work needs to be done in this field, especially when long-term scenarios have to be assessed (as scenarios that include new rail infrastructures for freight services).

Then, given the desirability of a joint modelling framework, the paper recalls a modelling system (Nuzzolo and Comi, 2014b; Comi and Nuzzolo, 2014), which takes into account several factors of end-consumer behaviour (such as the choice of retail outlet type), and links shopping and shop restocking mobility. It consists of two main steps (Figure 7):

- shopping model sub-system; it allows us to simulate end-consumer behaviour for shopping and to estimate quantity bought by end consumers in order to satisfy their needs, and hence to identify the freight flows attracted by each traffic zone;
- restocking model sub-system; given the quantity attracted by each traffic zone, it allows us to estimate the restocking quantity origin-destination (O-D) matrices characterized by freight types and type of vehicle used.

The shopping model sub-system allows us to point out the effects arising from implementation of medium/long-term actions on the location of retail outlets and places of residence, and due to changes in the characteristics of the population (e.g. demographic and socio-economic changes).

The restocking sub-system includes models for the simulation of the freight distribution process from the freight centres to the retail zone.

At the moment, this model system does not include a model of intra-urban freight modal-split. In the literature, models developed for this purpose refer mainly to intercity transport (de Jong, 2014), as for the urban context, the only available transport mode usually is road transport, therefore the mode choice is rarely modelled. The modelling system presented above is a multi-stage model. It considers a discrete choice approach for each decisional level and allows to include the modal split stage. The advancement of the actual restocking model sub-system, in order to take in to account the rail service, is presented in the next section 5.

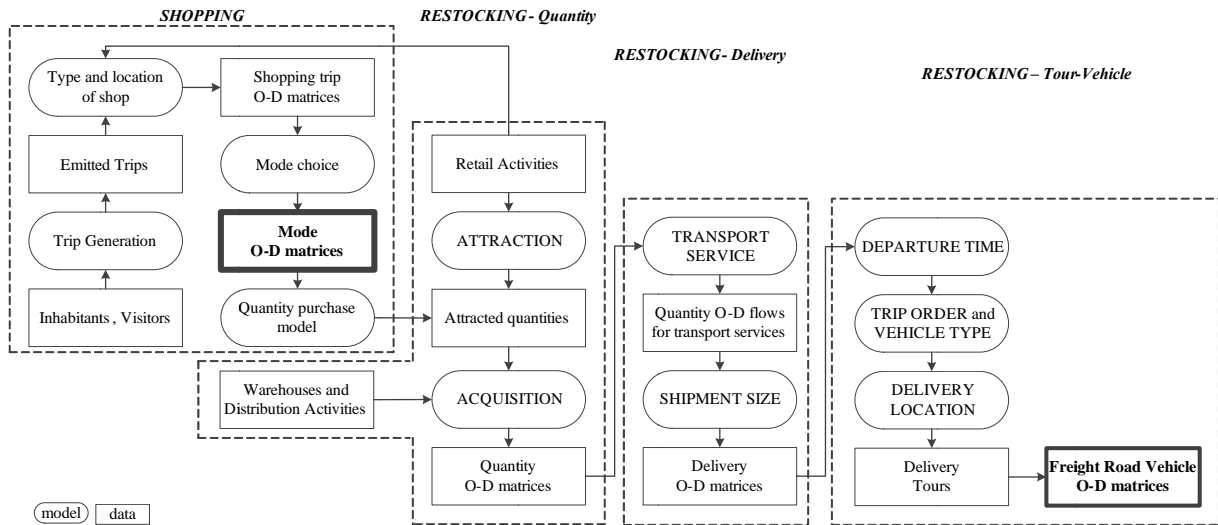


Figure 7 – Freight O-D estimation modelling

5 The proposed approach in transport service and mode choice modelling

The restocking sub-system model of the general demand model system reported in Fig. 7 can be updated, introducing transport service and modal choice models, as pictured in Fig. 8.

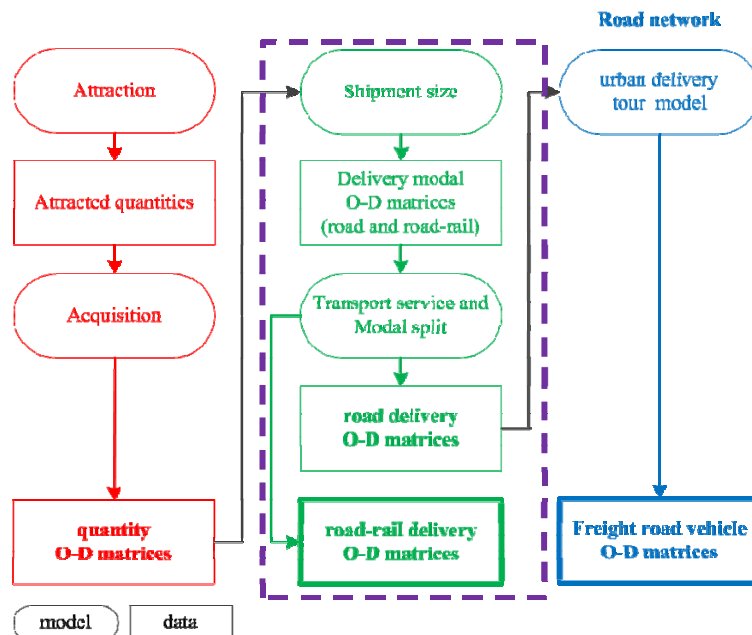


Figure 8 – Advancement in the existing modelling structure.

According to Figure 6, transport service and modal choice models have to be developed with different model specification, in relation to who the decision maker is:

- retailer on own account;
- wholesaler on own account;
- carrier.

Referring to retailer and wholesaler on own account, within the random utility theory approach (Ben-Akiva and Lerman, 1985), the nested modelling can be used, in order to take into account expected correlation among alternative. Therefore, the probability of mode m , $p[m/od]$ can be expressed as follows:

$$p[m/od] = p[r/od] \cdot p[m/rod] = \frac{\exp(V_r + \delta_r Y_r)}{\sum_{r'} \exp(V_{r'} + \delta_{r'} Y_{r'})} \cdot \frac{\exp(V_{m/r})}{\sum_{m'} \exp(V_{m'/r})} \quad (2)$$

where

- $p[r/od]$ is the probability to be restocked by transport service r (i.e. own account or carrier);
- $p[m/rod]$ is the probability to use mode m (i.e. road or road-rail) having chosen transport service “on own account”;
- V_r is the systematic utility for the choice alternative r ;
- Y_r is the logsum variable of group r obtained with the alternative specific systematic utilities $V_{m/r}$.
- $V_{m/r}$ is the systematic utility of the choice alternative m belonging to the group r .

Other different and more sophisticated random utility models able to simulating the above choices jointly are recalled in section 5.3.

According to carrier, only one choice dimension exists: mode choice. Then, the probability $p[m/od, carrier]$ can be expressed as follows:

$$p[m/carrier] = \frac{\exp(V_{m/carrier})}{\sum_{m'} \exp(V_{m'/carrier})} \quad (3)$$

where

- $p[m/od, carrier]$ is the probability to use mode m (i.e. road or road-rail) having chosen transport service “carrier”;
- $V_{m/carrier}$ is the systematic utility of the choice alternative m .

As detailed in previous section, in the literature, models developed for this purpose refer mainly to intercity transport. In urban context, while few models for transport service choice were developed, mode choice with rail alternative is rarely, if ever, modelled. Then, in the following sub-sections, before the current models for transport service type are recalled, then some examples of utility functions for transport service and modal choice models are described.

5.1 The current transport service models

From the data collected in the city of Rome, different shares according to transport service type have been revealed in relation to freight types as reported in Table 2. From some retailer interview data (Comi, 2013; Nuzzolo and Comi, 2015), a binomial logit model was calibrated with two types of transport service: retailers on own account (c_{oa}) and other transport service types (c_{ip}). The calibration was performed by Maximum Likelihood (ML) method and the model capability to reproduce the choice made by sample was measured by ρ^2 statistic. The systematic functions of the two identified transport service alternatives were expressed as follows:

$$V_{c_{oa}} = ASA_{c_{oa}}$$

$$V_{c_{ip}} = \beta_1 \cdot PROD + \beta_2 \cdot CD + \beta_3 \cdot WH + \beta_4 \cdot DPT + \beta_5 \cdot EM + \beta_6 \cdot ADY + \beta_7 \cdot q + \beta_8 \cdot TIME \quad (4)$$

where

- V_{coa} is the systematic utility for transport *on own account*,
- V_{cip} is the systematic utility for transport *by carrier or wholesaler on own account*,
- $PROD$ is a dummy variable equal to 1 if the restocked freight arrives from a *producer*,
- CD is a dummy variable equal to 1 if the restocked freight arrives from a *distribution center*,
- WH is a dummy variable equal to 1 if the restocked freight arrives from a *wholesaler*,
- DPT is a dummy variable equal to 1 if the attractor owns a store,
- EM is the number of employees at shop to be restocked,
- ADY is a dummy variable equal to 1 if the deliveries are received all days,
- q is the average *shipment size*, expressed in tons;
- $TIME$ is the time spent for delivering.

Table 2 – Transport service type: shares revealed in the inner area of Rome (Nuzzolo and Comi, 2015)

	retail on own account	wholesaler on own account	carrier	total
Foodstuffs	15%	61%	24%	100%
Home Accessories	31%	46%	23%	100%
Stationery	11%	65%	24%	100%
Clothing	11%	42%	47%	100%
Building Materials	6%	40%	54%	100%
Household and personal hygiene	9%	22%	69%	100%
Other goods	28%	21%	51%	100%
Total (average share)	20%	49%	31%	100%

As point out some studies focusing on this field (Danielis et al., 2010), the type of services is also strictly dependent to the type of attractor. Table 3 reports the sets of parameters estimated for the different types of attractors. As revealed by surveys, we can see that the probability of being restocked by other transport service types rises if freight comes from a distribution centre. This probability also increases with the number of employees at the shop and with shipment size. Activities related to foodstuffs tend to be restocked more than others from distribution centre and prefer carrier's service. The probability to be restocked by carrier increases with availability of depots and weight changes according to attractor type.

Table 3 – Transport service type: calibration results

Attributes	Bar		Hairdresser		Hotel		Restaurant and foodstuff retailer		Other		
	Value	t-st	Value	t-st	Value	t-st	Value	t-st	Value	t-st	
<i>Carrier or wholesaler on own account (c_{ip})</i>											
from producer (PROD)	0/1	1.90	2.2	1.76	1.9	2.32	3.4	3.03	4.4	0.95	1.7
from distribution centre (CD)	0/1	2.37	3.4	2.92	3.0	2.4	2.9	3.4	4.9	1.44	1.9
from wholesaler (WH)	0/1	1.89	2.5	1.51	1.2	1.21	1.3	2.28	1.6	0.91	1.9
presence of depot (DPT)	0/1					2.87	4.2	0.46	3.8	0.55	1.5
number of employees (EM)						0.033	2.0	0.054	1.0	0.25	1.4
deliveries received all day (ADY)	0/1	-0.89	-1.4			-0.87	-1.4	-0.27	-1.5		
quantity per delivery (q)	tons	0.40	1.4							0.6	1.5
minutes spent for delivery (TIME)	min			0.012	1.9			0.005	1.4		
<i>Receiver on own account (c_{oa})</i>											
ASA	0/1	0.5	1.8	1.04	1.2	1.21	2.1	2.93	3.4	1.36	1.8
ρ^2		0.29		0.22		0.31		0.23		0.28	

These results are quite useful in order to develop new modal choice models, as reported in the next sub-section 5.2.

5.2 Transport service and modal choice utility functions

On the bases of the previous analyses and according to each decision maker, the systematic utility for transport service and mode choice alternative should be expressed in function of the following attributes:

- type of commodity chain
 - freight type (e.g. foodstuffs, clothing, home accessories),
 - characteristics of attractor type,
 - characteristics of shipper,
 - characteristics of delivery (e.g. shipment size, delivery time),
 - requirements of freight (e.g. package, cool chain),
 - time constraints;
- Characteristics of mode alternative
 - access/egress travel times and costs,
 - travel time,
 - travel cost,
 - availability of storage at inner rail stop.
 - availability of tracing service.

Then, an example of systematic utility function for the alternative *transport servicer* (V_r) is the following:

$$V_r = \beta_1 \cdot X_{attr} + \beta_2 \cdot X_{emp} + \beta_3 \cdot X_{ftype} + \beta_4 \cdot q + \beta_5 \cdot X_{tconst} + \beta_6 \cdot X_{cool} + \beta_7 \cdot X_{tccar} + \beta_8 \cdot X_{ttcar} + \beta_9 \cdot X_{warehouse} + \beta_{10} \cdot X_{tracing} + \beta_{11} \cdot Y_r$$

where

- X_{attr} is a dummy variable equal to 1 if the attractor is a food-and-drink outlet (e.g. bar, restaurant), 0 otherwise;

- X_{emp} is the number of employees of attractors;
- X_{ftype} is a dummy variable equal to 1 if freight is foodstuffs, 0 otherwise;
- q is the shipment size;
- X_{tconst} is a dummy variable equal to 1 if the deliveries has to be performed before 10 am, 0 otherwise;
- X_{cool} is a dummy variable equal to 1 for cool deliveries, 0 otherwise;
- X_{tccar} is a travel time by transport service *carrier*;
- X_{tccar} is a travel cost by transport service *carrier*;
- $X_{warehouse}$ is a dummy variable equal to 1 if storage service is provided by transport service *carrier*, 0 otherwise;
- $X_{tracing}$ is a dummy variable equal to 1 if tracing service is provided by transport service *carrier*, 0 otherwise;
- Y_r is the logsum variable of group r .

Referring to *modal choice*, an example of systematic utility function for alternative mode m ($V_{m/r}$) is the following:

$$V_m = \beta_{21} \cdot X_{ttae} + \beta_{22} \cdot X_{tccae} + \beta_{23} \cdot X_{ttc} + \beta_{24} \cdot X_{warehouse_rail} + \beta_{25} \cdot X_{tracing_rail} + \beta_{26} \cdot X_{aveh}$$

where

- X_{ttae} is the travel time for access/egress;
- X_{tccae} is the travel cost for access/egress;
- X_{ttc} is the travel cost on mode m ;
- $X_{warehouse_rail}$ is a dummy variable equal to 1 if storage service is provided by *rail service*, 0 otherwise;
- $X_{tracing_rail}$ is a dummy variable equal to 1 if tracing service is provided by *rail service*, 0 otherwise;
- X_{aveh} is the number of road vehicles owned by decision maker;

We have to note that different ranges of some attributes can be considered in the utility functions in order to deal the non-linear effects (Marcucci and Gatta, 2014).

Of course, during the model parameter estimation procedure, the best functional form and the best variables (combination of the above attributes), according to the best “statistical quality” of the model and taking into account the application requirements, have to be found.

5.3 Alternative Random Utility models

A highly flexible model that can approximate any random utility model is the Mixed Logit (McFadden and Train, 2000; Hensher and Green, 2003). It obviates the main limitations of standard logit by allowing to deal properly:

- the preference heterogeneity across decision makers or groups (Hensher and Green, 2003; Marcucci et al., 2013),
- the correlation among perceived utilities of the choice alternatives (Train, 2009).

As it is well known, in the Mixed Logit (ML) models it is assumed that the vectors of parameters θ are random variables with probability density function $f(\theta)$. The probability $p^i[j]$ of Mixed Logit

(ML) model, that the decision maker i chooses the alternative j , is the integral of standard logit probabilities over a probability density function of parameters (Train, 2009):

$$p^i [j] = \int L_j^i(\theta) \cdot f(\theta) \cdot d\theta$$

where $L_j^i(\theta)$ is the logit probability, evaluated at a set of parameters θ .

If θ are discrete random variables (i.e. if θ takes only M values, labelled β_1, \dots, β_M), then ML becomes the *latent class* model. This model is useful when there are M distinct segments in the population, each with own choice behaviour (Train, 2009). If $M=I$, then the ML becomes the multinomial logit model.

The ML model can assume the similar specification of standard multinomial logit except that θ varies over decision makers rather than being fixed. At the other hand, the correlation among the perceived utilities of the choice alternatives can be taken into account specifying a correlation structure of the random residuals (Train, 2009; Ortuzar and Willumsen, 2011).

6 Data collecting

The estimation of above demand models can be obtained by using different sources of information and statistical procedures. Model estimation requires that the models are specified (i.e. the functional form and the variables are defined) and the unknown coefficients are estimated, and validated (i.e. the ability to reproduce the available data is tested). These operations can be performed on the basis of disaggregate information relative to a sample of decision makers.

The surveys used to gather elementary information might belong to two different classes: surveys relative to the actual choices in a real context (Revealed Preferences or RP surveys) or surveys relative to the hypothetical choices in fictitious scenarios (Stated Preference or SP surveys).

The revealed Preferences (RP) surveys provide information on decision makers' choice relevant for the model to be developed. Then, they should allow:

- to analyse the behaviour of the decision makers (i.e. retailer, wholesaler and carrier) in relation to the characteristics of decision makers and of deliveries;
- to identify the factors that influence the potential commodity chain to be shift towards multimodal transport;
- to identify the requirements of freight (e.g. package, cool chain);
- to identify the characteristics of delivery trip;
- to identify the requirements and performance of mode alternatives.

Stated preferences (SP) surveys differ in that they are conceptually equivalent to a laboratory experiment designed with a larger number of "degrees of freedom". They should be carried out on a sample of deliveries in order to model the propensity to use new freight distribution modes.

During the interview, the decision-maker is usually presented with different scenarios or choice contexts. A scenario is defined by the set of alternative options; each option is accompanied with some attributes or factors defining its characteristics:

- access/egress times and costs
- travel time of mode,
- travel cost time of mode,
- availability and cost for storage,
- availability of tracing service,
- delivery time constraints (e.g. morning before 10.00 am).

In the choice contexts proposed, the attributes vary between a prefixed number of values, or levels. These levels can be defined in absolute terms, e.g. travel times and costs, or obtained as percentage variations with respect to the values of the attributes for a real context experienced or known to the decision maker (e.g. times and costs relative to certain origin-destination pairs).

The decision-maker can be asked about different types of preference:

- choice, i.e. an indication of which option he/she would choose in that context;
- ranking, i.e. a ranking of the available options according to his/her preferences;
- rating, i.e. the assignment of a vote of preference on a predefined scale for each alternative option.

Results of SP surveys are significantly better if choice scenarios are in the direct experience of the decision maker. In this way the distortion effects, due to hypothetical scenario do not fully perceived by decision maker, can be reduced considerably. One of the most important issues of using SP surveys is the generation of multiple observations by each decision maker. Although this problem received a little more attention at the end of the 1990s, it is only in recent years that it has been handled correctly using Mixed Logit models (Revelt and Train, 1998; Ortuzar and Willumsen, 2011). Furthermore, SP surveys can be considered as complementary to traditional RP surveys and the combined use of the two types of surveys can balance reciprocal merits and shortcomings. From the point of view of demand modelling, it is therefore useful to carry out joint calibrations using RP and SP surveys on the same sample or on different samples of users. The Mixed Logit (ML) model offers much in terms of the appropriate mixing of revealed and stated preference data (Bhat and Castelar, 2002; Train and Wilson, 2008) and also of effects due to repeated observations (Ortuzar et al., 2000).

7 Conclusions

The congestion in urban areas, the restrictions applied for environmental issues, and the reduction of accessibility of particular urban centres, have been forwarded researchers to investigate solutions to define modal alternatives to road transport for freight shipments.

This paper presented some methodological aspects for modelling the demand for rail in an urban context. The literature review shows a lack in mode choice modelling. In fact, the mode choice with rail alternative in an urban freight context has been rarely, if ever, modelled. Therefore, a choice modelling structure has been proposed, that includes the choice of the type of service and the mode transport on the basis of previous analysis and model at urban freight context. Finally, some aspects of data collecting have been considered, together with the model calibration issues.

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