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Urban freight transport demand: transferability of survey results analysis and models

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Abstract

The present research addresses the issue of data collection, models and methods for urban freight transport demand investigation and the difficulties related to costs and the fact that few data are often available. Then, it becomes important to investigate the transferability of results in order to improve their use and to assess whether the obtained results is dependent on any particular condition, and whether the lessons learnt in one city can be transferred to other cities. The transfer of a previously estimated model to a new application context can reduce or eliminate the need for a large data collection and model development effort in the application context. Therefore, the main goal of the research is to compare the freight transport demand in two European cities (Rome and Santander) in order to highlight which similarities and differences depend on some factors and demonstrates that there are many different patterns of urban distribution that need to be taken into account. The analysis is based on some similar surveys carried out in the cities that are also very different in terms of spatial and economic patterns. Furthermore, the available surveys in Rome and Santander have been the basis for the calibration also in Santander of a modelling system for urban freight demand forecast set up in Rome. In such a way, the analysis of model and parameter transferability is also investigated.

Keywords: urban freight transport; city logistics; urban freight demand

1. Introduction

The role of freight transport as an important part of the day-to-day activities for business and people is still increasing, especially if we analyze the recent trends of e-commerce, economic globalization, high-tech

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warehousing and *just-in-time* production systems. In addition, when compared with the passenger vehicle fleet, trucks can have significant impacts in road congestion, greenhouse gas and pollutant emissions and pavement wear (Behrends *et al.*, 2008; Russo and Comi, 2011a).

Consequently, it is fundamental to have methods and models to allow an *ex-ante* assessment of policies and measures that can be implemented by local administrators in order to make urban freight mobility more sustainable. This approach need freight data for different purposes: to provide an understanding of freight operations, to obtain data to be used in urban freight models for forecasting, to monitor the effects of policy measures. Therefore data are essential in helping public and private sector decision-makers to ensure that urban freight transport is efficient and sustainable.

Since urban freight systems are complex and cities differ in size and other characteristics, site-specific data could be required for the development of assessment methodologies (including models) which could support the sustainable management of urban logistics (Lindholm and Nehrends, 2012).

As Ogden (1992) has noted it is not possible to make definitive comments about the data needs when studying urban freight transport. These will vary depending on the issue/s concerned, the planning and policy framework in which the issue arises, established practice in data collection, and the availability of previously collected data.

In the current literature, several authors have investigated the methods used for collecting data (Ambrosini and Routhier, 2004; Browne *et al.*, 2007a; Dasburg and Schoemaker, 2006, Schoemaker *et al.*, 2006; BESTUFS, 2008; Allen and Browne, 2008; Holguín-Veras and Jaller, 2012) confirming that the freight transport investigation present several difficulties related to costs and the fact that few data are often available. Then, it becomes important to investigate the transferability of survey results in order to improve their use and to assess whether the obtained results is dependent on any particular condition, and whether the lessons learnt in one city can be transferred to other cities (Browne *et al.*, 2007b).

In this context, the paper, using some similar surveys carried out in two European cities (Rome and Santander) that are also very different in terms of spatial and economic patterns, and traffic regulation, highlights which differences or similarities exist and, then, to point out which results can be transferred from one city to other ones. These analyses can be useful for verifying which factors need in-depth and specific investigations. Furthermore, the available surveys have been the basis for the calibration also in Santander of a modelling system for urban freight demand forecast set up in Rome (Nuzzolo *et al.*, 2010). In such a way, the analysis of model and parameter transferability is also investigated.

The rest of paper is organised as follows. Section 2 provides a description of the two studied cities and the surveys areas from the point of view of socio-economic characteristics and commercial structure, including description of areas and survey outline. Section 3 presents the analysis of freight demand for the two cities, while section 4 investigates the transferability of the freight demand forecast model set up in Rome to the case of Santander. Finally, some conclusions are given in section 5.

2. Studied Cities

In this section socio-economic characteristics and commercial structure of the each city and the surveys areas have been detailed in order to define the spatial patterns characterizing the urban freight distribution. In particular, a description of the respective study areas considered in each city, population data, extension of the study area, number of shops and number of warehouses. Also, where the warehouses/restocking centres are located respect to the shops to be restocked is analysed through the retailer and warehouse employees respect to population.

2.1. Overview of cities

Rome is the country's largest and most populated city, with over 2.7 million residents in 1,285.3 km^2 and, then an average population density of more than 2,100 inhabitants per km^2. In Rome (Filippi *et al.*, 2008), there are about 46,000 retailers (with about 140,000 employees) and about 18,000 warehouses (with about 49,000 employees). The economy of Rome is characterised by the absence of heavy industry and it is largely dominated by services, high-technology companies, research, construction and commercial activities (especially banking), and the huge development of tourism are very dynamic and extremely important to its economy.

On the contrary, Santander is a medium-sized city situated in the North coast of Spain which had a population of 181,589 in late 2010 distributed over a surface area of 35 km^2, which means a population density of 5,188 inhabitants per km^2 approximately. In late 2010 Santander counted 4,717 commercial activities, 4,161 being retailers, which is the 88%. This fact reveals the preponderance of this kind of commercial activity in this city. The industrial sector has a slightly lower weight given the fact that in late 2010 a total of 2,242 industrial activities were registered, 1,208 were related to construction (54%), 617 to industrial sector (27%) and the remaining 19% to other sectors. Focusing on the retailers, the total of 4,161 shops means 119 shops per km^2 approximately (Table 1).

Table 1. Synthetic indicators of investigated cities.

Indicators	Rome		Santander	
	Municipality	*Study area*	*Municipality*	*Study area*
n. of inhabitant / n. of shops	59.41	9.63	28.22	31.23
n. of retail employees / n. of shops	3.01	4.14	1.63	1.75
number of warehouses / n. of shops	0.40	0.13	0.27	0.10
number of employees at warehouses / n. of warehouses	2.60	2.42	2.56	2.50
m^2 of shops / number of inhabitants		11.57	3.84	5.00
Average dimension of shops (m^2)		111.50	120.00	156.00

2.2. Surveys areas

The surveys area in Rome is the inner area of the city where traffic regulation both for passenger and commercial vehicles exists. This area is a mixed land-use area (c.b.d., residential, commercial, touristic) and the most famous zone in the city, with the main touristic monuments and many shopping streets reserved to pedestrians. It has an extension of about 6 km^2, about 50,000 inhabitants and 130,000 employees. The population density of the area as a whole is more than 8,900 inhabitants/km^2. Inside the area study there are 5,337 shops with 22,106 employees. In relation to wholesaler activities there are 676 warehouses with 1,635 wholesale employees. In reference to the total area of Rome, the Figure 1 shows the density of retail employees respect to population and the density of warehouses employees respect to population, in the area of study and surrounding areas. We can see that the higher retail concentration is in the inner area while the higher wholesaler concentration refers to the surroundings that also are along the main roads.

At same way, the inner area of Santander has been identified. This area brings together the downtown of the city and the nearby neighbourhoods (see Figure 2). The study area has a total surface of 7.7 km^2 with 140,712 inhabitants, with 55,186 employed and 5,651 unemployed. The population density of the area as a whole is quite higher with more than 18,000 inhabitants /km^2. Inside the area study there are 4,505 shops with 7,900 employees. In relation to wholesaler activities there are 436 warehouses with 1,091 employees. For what concerns the total area of Santander and surrounding areas, the figure 2 shows the density of retail employees respect to population and the density of warehouse employees respect to population, in the area of study and surrounding areas. The spatial distribution of retailers concentrates in the center area and in the central directional artery road, the one that supports the maximum flow of vehicles. Wholesale activities, on the other hand, show a wider spread and a more important presence in the outlying areas of the city.

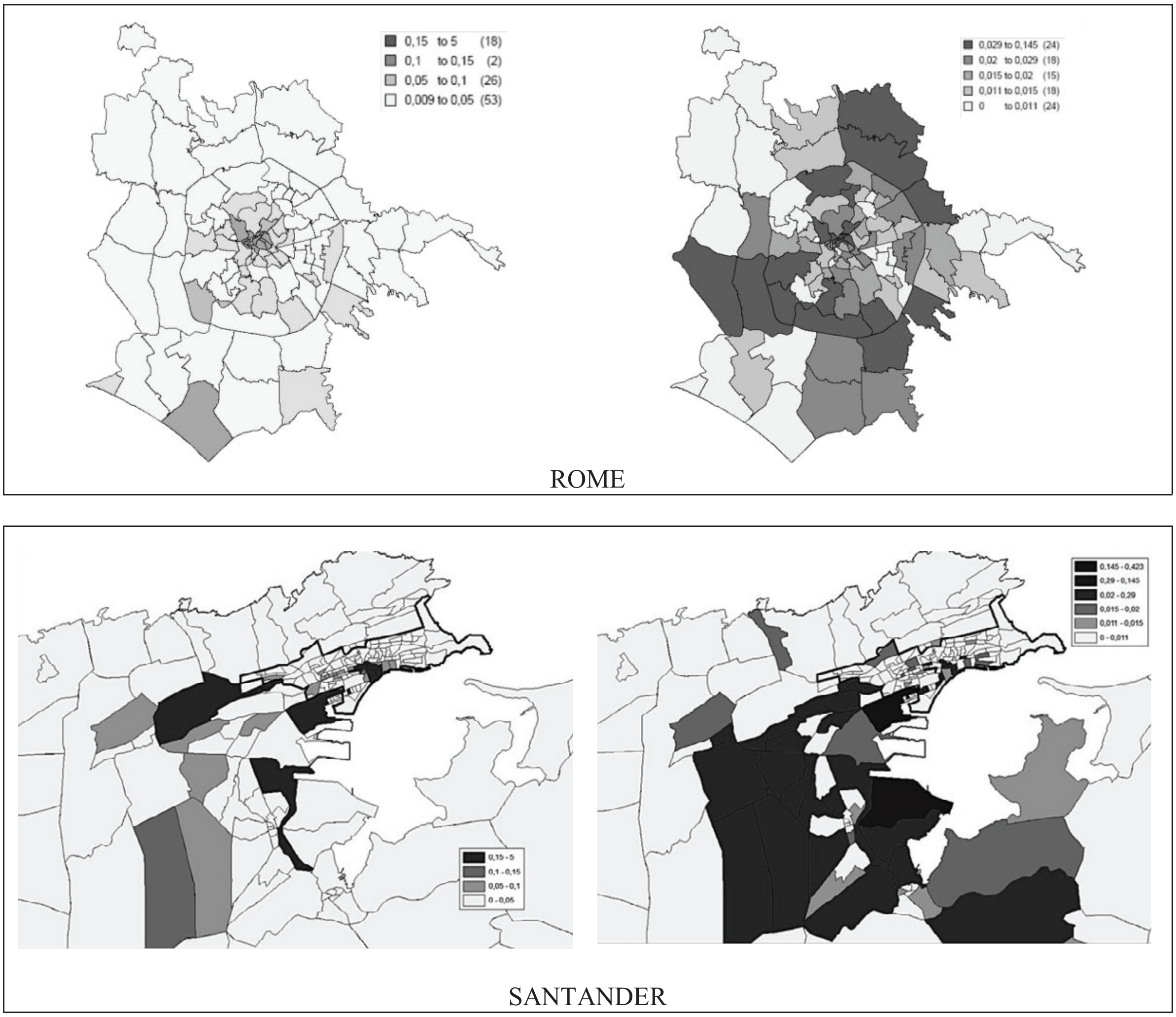

Fig. 1. Distribution of density of retail employees (left) and warehouse employees respect to population (right).

3. Freight demand analysis

The data collected in the city of Rome and Santander have allowed to deepen the characteristics of freight demand and, in particular, to highlight if similarities not depending on specific city characteristics exist.

The analyses of freight transport have been based on data collected through the following surveys:

- in Rome, three types of surveys has been carried out (Filippi *et al.*, 2008): traffic counts of commercial and private vehicles during 14 hours (from 7:00 to 21:00); telephone interviews to 575 retailers; and interviews to 502 truck drivers;
- in Santander, three types of surveys have been also carried out: traffic counts on the main streets of the road network 4 hours (from 9:00 to 13:00); interviews to 401 retailers; and interviews to 121 truck drivers;

The characteristics of freight demand have been investigated in order to study for each city the: commodity flows per freight types, shipment size for freight and transport service types. This analyses of freight transport have been performed using the same freight classification, consisting of: foodstuffs, home accessories, stationery, clothing, building materials, household and personal hygiene and other goods.

In reference to the composition of commodities flow, Figure 2 shows the distribution of daily commodity flows per freight types. We can note that the share of foodstuffs is greater in Santander. This difference is strictly related that the Roma area is an historic and tourist area and few shops for daily consumption are located. It is also confirmed by the higher shares of not daily consumption goods as home accessories and stationery products. Reflecting the obvious differences among the total quantities moved within each surveys area, the average quantity moved by each retail employee is quite similar in the city of Rome (0.65 t/employee) and Santander (0.70 t/employee).

Table 2 shows the average shipment size for freight types. The value revealed in Santander seems similar with Rome, except in the category of foodstuffs (Rome is 358 kg and Santander 590 kg), but it is mainly due to the study area of Santander is more extensive (in relation to the total size of the municipality) than Rome and there are many supermarkets that require larger deliveries. While in Rome the average dimension of shops is 111.5 m^2, in Santander is 519 m^2 (see Table 1).

Regarding the used transport services type, although in Rome some regulations have been implemented in order to push retailer toward third party (Nuzzolo and Comi, 2012). This explain the difference between the share of retailer that restocks in own account in Rome and Santander (see Table 3).

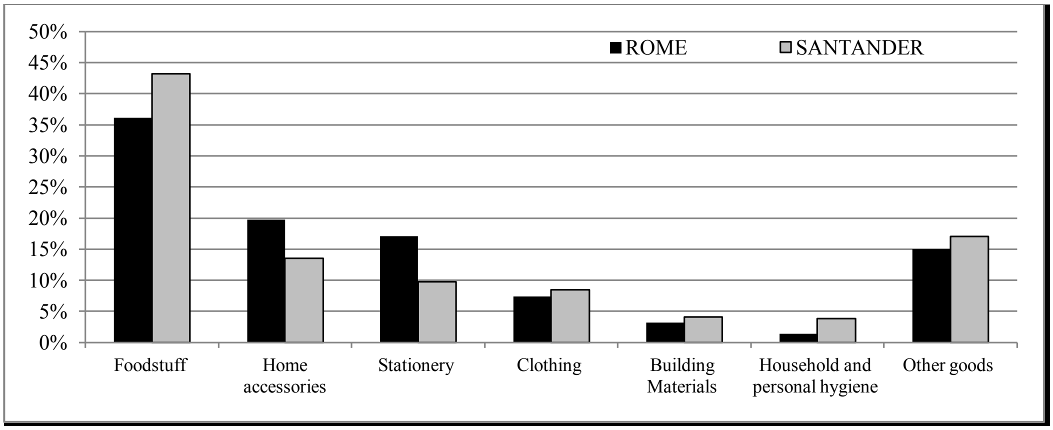

Fig. 2. Composition of commodity flows (%)

Table 2. Shipment size by freight type (kg).

	Rome	Santander
Foodstuffs	358	590
Home accessories	956	502
Stationery	593	228
Clothing	366	175
Building Materials	470	183
Household and personal hygiene	208	127
Other goods	530	683
Average	**481**	**492**

Table 3. Distribution of urban transport services types

	Rome	Santander
Retailer in own account	20.5 %	37.9 %
Wholesaler in own account or carrier	79.5 %	62.1 %

4. Transferability of the freight demand model

This section analyses the transferability of a model for urban freight demand forecast set up in Rome (Nuzzolo *et al.*, 2010) to the city of Santander. This model was developed in order to analyse the urban freight transport and logistics within urban and metropolitan areas, and to support the assessment of city logistics policies. This modelling system was specified and calibrated using some surveys carried out in the inner area of Rome.

The modelling system consists of two sub-systems (Figure 3): the first related to the demand and the second related to the logistics. In this paper we analyse the transferability of the demand sub-system.

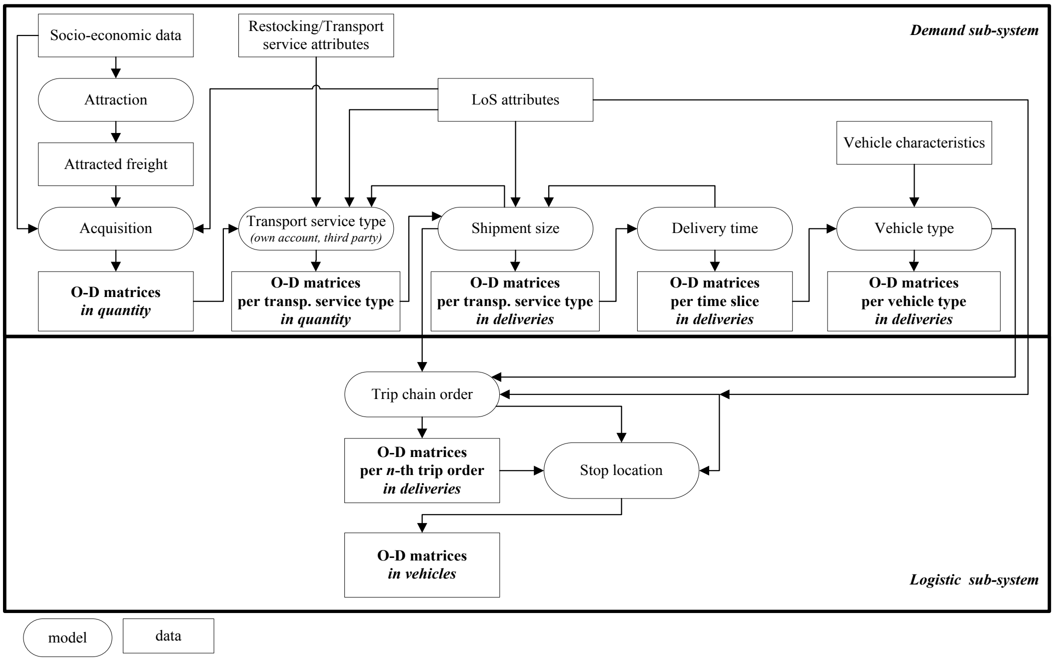

Fig. 3. System models architecture for simulating urban goods movements (Nuzzolo *et al.*, 2010)

The proposed modelling system is detailed in (Nuzzolo *et al.*, 2010). Specification and calibration of the sub-models in the city of Santander is here reported and compared with the results in Rome. The presented models are the result of several specifications and calibrations based on different combinations of possible attributes. In the following, the first calibrated models that performed the best statistical significances are reported.

4.1. The attraction model

The attraction models developed are regression models expressing the average quantity of freight attracted by zone d, Q_d, as follows

$$Q_d = \beta_{ad} \times AD_d + \beta_{asa} \times ASA_d \tag{1}$$

where

- AD_d is the total number of employees in zone d;
- ASA_d is a *dummy* variable introduced in order to measure the different power of selling in zone d with high shop density; it is equal to *1* if ratio between retailer employees and resident in the zone d is higher

than 35%.

Table 4 reports values of β_i parameters calibrated for the seven freight types. The models have been calibrated using Generalized Least Square (GLS) estimator and all parameters are correct in sign and are statistically significant as shown by *t*-student values.

Results highlight that the variable AD_d is statistically significant for all freight types, both for Rome and Santander, and the weight is similar for some freight types. For the case of Santander the variable ASA_d is statistically significant only for Stationary and Clothing.

Table 4 – Attraction models: calibration results [t/day].

		Foodstuffs	Home accessories	Stationery	Clothing	Household Personal hygiene	Building	Other goods
Rome	β_{AD}	0.06 *(1.89)*	1.6 *(2.52)*	2.9 *(1.85)*	0.1 *(2.99)*	0.1 *(1.85)*	1.3 *(8.93)*	1.2 *(3.48)*
	β_{ASA}	599.7 *(5.96)*	240.7 *(2.53)*	311.28 *(4.90)*	134.5 *(3.18)*	41.7 *(2.35)*		191.1 *(3.53)*
	R^2	0.91	0.79	0.89	0.75	0.59	0.89	0.80
Santander	β_{AD}	0.25 *(5.64)*	1.97 *(8.83)*	0.68 *(3.02)*	0.17 *(6.78)*	0.35 *(7.27)*	1.83 *(3.98)*	0.98 *(4.07)*
	β_{ASA}			192.21 *(3.48)*	33.58 *(4.61)*			
	R^2	0.68	0.88	0.92	0.79	0.67	0.94	0.76

4.2. The acquisition model

In order to know the origin of freight for a given attraction zone *d*, *gravitational models* have been specified and calibrated. It aims at estimating $p[o/d]$, that is the share of freight attracted by zone *d* coming from zone *o* (e.g. firm, distribution centre, warehouse, etc. are located) as:

$$p[o/d] = \left(AI_o\right)^{\beta_1} \cdot C_{od}^{\beta_2} \Big/ \sum_{o'} \left(AI_{o'}\right)^{\beta_1} \cdot C_{o'd}^{\beta_2} \tag{2}$$

Table 5 reports calibration results obtained for the acquisition model. Even if acquisition models have been calibrated for all freight types before recalled, similar results have been obtained. By analysing results of Table 5 it is possible to point out that, in the case of Rome, the number of employees has a high weight for foodstuffs, while the weight of travel cost (travel distance) plays at same way. For the case of Santander, we obtain values within the same range as Rome.

Table 5 – Acquisition models: calibration results.

	ROME		***SANTANDER***
	Foodstuffs	***Remaining goods***	***All goods***
β_1 AI_o is number of warehouse employees of zone	2.1 *(1.94)*	0.13 *(2.63)*	1.15 *(2.03)*
β_2 the length of travel trip between *o* and *d*	-0.05 *(1.85)*	-0.08 *(2.80)*	-0.03 *(1.87)*
R^2	**0.45**	**0.52**	**0.39**

4.3. The transport service type model

The quantity O-D matrices per transport service-type are obtained using a transport service model. This model allows to split the O-D quantity flows for the previous identified transport service. Table 6 reports the revealed shares obtained by the previous survey analysis.

In the city of Rome restocking in own account by sender has an average share of 49%, but it strongly function of freight type. For example, this percentage increases over 60% for foodstuffs and stationery and it decrease to 22% for household and hygiene products. Note that in Rome the municipality has implemented some incentives to switch from retailer in own account to third parties. Thus, we have revealed that now few retailers restock in own account (less than 20%). In the city of Santander retailers restock in own account is bigger for all freight types, except in Home Accessories, Stationary and Building.

Table 6 – Restocking models: revealed shares.

	ROME			***SANTANDER***	
	Receiver in own account	***Sender in own account***	***Third party***	***Receiver in own account***	***Wholesaler in own account or carrier***
Foodstuffs	15%	61%	24%	49%	51%
Home Accessories	31%	46%	23%	25%	75%
Stationery	11%	65%	24%	4%	96%
Clothing	11%	42%	47%	23%	77%
Building Materials	6%	40%	54%	2%	98%
Household and personal hygiene	9%	22%	69%	27%	73%
Other	28%	21%	51%	50%	50%
Total (average share)	**20%**	**49%**	**31%**	**38%**	**62%**

From these data, a binomial logit model has been specified and calibrated. In particular, the interview results have allowed to identify two types of transport service: retailer in own account (c_{oa}) and third party (c_{tp}). The systematic function of the two identified transport service types has been expressed as follows:

$$V_{c_{oa}} = \beta_{c_{oa}} \cdot ASA_{c_{oa}}$$
$$V_{c_{tp}} = \beta_{prod} \cdot PROD + \beta_{cd} \cdot CD + \beta_{wh} \cdot WH + \beta_{fgt} \cdot FGT + \beta_{em} \cdot EM + \beta_{q} \cdot q \quad (3)$$

Table 7 reports calibration results. The presented model is the result of several specifications and calibrations based on different combinations of possible attributes.

Table 7 – Restocking models: calibration results.

			ROME	SANTANDER
Attribute	**Symbol**	**Parameter**	**Value**	**Value**
Producer, dummy variable equal to *1* if the restocked freight arrives directly from the *producer*, *0* otherwise	*PROD*	β_{prod}	1.97*(6.3)*	
Distribution Center, dummy variable equal to *1* if the restocked freight arrives directly from a *distribution center*, *0* otherwise	*CD*	β_{cd}	2.56*(7.8)*	
Wholesaler, a dummy variable equal to *1* if the restocked freight arrives directly from a *wholesaler*, *0* otherwise	*WH*	β_{wh}	1.82*(6.4)*	
Number of employees	*EM*	β_{em}	0.023*(1.5)*	0.052 *(3.3)*
Retailer type, is a dummy variable equal to *1* if the restocked shops is a *public concern* (e.g. bar, restaurant), *0* otherwise	*FGT*	β_{fgt}	-0.032 *(-1.6)*	-0.006 *(-1.3)*
Shipment size (kg)	*q*	β_q	0.0006*(1.3)*	0.0024 *(1.9)*
Alternative Specific Attribute (ASA)	$ASA_{c_{oa}}$	$\beta_{c_{oa}}$	1.008 *(3.4)*	0.979 *(2.2)*
ρ^2			**0.21**	**0.26**

In the city of Rome we can see that the probability to be restocked by third party increases if the restocking origins from producer establishment or distribution centre or wholesaler. In the case of Santander was not possible to discern the origin of the freights. In both cities, the probability increases with increasing of number of employees at shop and shipment size, more clearly in the case of Santander. However, public concerns tend to restock in own account, although this trend has more weight in Rome than in Santander.

4.4. The shipment size model

In order to convert the O-D flows from quantities to deliveries, the average delivered quantity (shipment size), $q[r]$, has been estimated. Table 8 reports the different delivery size revealed by surveys. In Rome, the average quantity varies from about 0.5 tons for retailer in own account to 0.35 tons of carrier (third parties); this result is justified by the fact that retailers in own account are characterized by a lower number of stops/deliveries.

The total value revealed in Santander seems similar with Rome, except in the category of foodstuffs (Rome is 0.358 and Santander 0.590 kg), but it is mainly due to the study area of Santander is more extensive (in relation to the total size of the municipality) than Rome and there are many supermarkets that require larger deliveries.

Table 8 – Delivery size: revealed average quantity [tons/delivery].

	ROME			**SANTANDER**
	Receiver in own account	***Sender in own account***	***Third party***	**All types**
Foodstuffs	0.389	0.367	0.232	0.590
Home Accessories	1.197	0.982	0.611	0.502
Stationery	0.569	0.632	0.412	0.228
Clothing	0.238	0.306	0.275	0.175
Building Materials	0.141	0.395	0.787	0.183
Household and personal hygiene	0.300	0.129	0.196	0.127
Other	0.423	0.394	0.497	0.683
Total *(average)*	**0.507**	**0.475**	**0.345**	**0.492**

4.5. The delivery time model

The delivery O-D flows can be characterised for time slice τ. In many cities around the world, including our test case, time is constrained by governance regulations: the public authorities define one or two time windows. It determines that all transport service types have to respect the same time constraints. Referring to data collected in the cities of Rome and Santander, it emerges that for many freight types more than 70% of deliveries refer to the morning period (Table 9). However, significant differences are found: the building materials are distributed more early in Santander, clothing and home accessories are distributed throughout the morning in Santander (9 a.m – 1 p.m.) while Roma is earlier (before 11 a.m.), and finally the freight distribution after 4 p.m. in Santander is focused in Stationery freight.

Table 9 – Time distribution: revealed shares.

	before 9am		***9am–11am***		***11am – 1pm***		***1pm-4pm***		***after 4pm***	
	Rome	***Santander***	***Rome***	***Santander***	***Rome***	***Santander***	***Rome***	***Santander***	***Rome***	***Santander***
Foodstuffs	30%	39%	40%	40%	24%	40%	6%	7%	0%	2%
Home Accessories	30%	20%	37%	59%	17%	59%	13%	4%	3%	2%
Stationery	34%	11%	50%	55%	9%	7%	7%	9%	1%	18%
Clothing	23%	5%	51%	56%	15%	56%	11%	0%	1%	0%
Building Materials	38%	54%	42%	21%	10%	21%	4%	4%	5%	0%
Household and personal hygiene	47%	30%	32%	50%	19%	50%	2%	3%	0%	0%
Other	27%	14%	31%	53%	21%	53%	20%	4%	0%	3%
Total *(average)*	**34%**	**29%**	**40%**	**45%**	**16%**	**45%**	**9%**	**7%**	**1%**	**2%**

4.6. The vehicle type model

The delivery O-D matrices can be characterised by vehicle type using a *vehicle type model*. A statistic-descriptive model has been set up from truck driver interviews. It allows us to obtain the vehicle type share independently form transport service type *r*, as reported in Table 10. Analysing data of Table 10, we can see that in Rome about the 60% of the whole transport pertains to trucks with capacity less than 1.5 tons, which move an average load of about 0.76 tons per vehicle (load factor near 50%). Other type of trucks represent about the 40% of the whole but their average transported quantity is about twice more (1.65 tons) than that of light goods vehicles.

In the case of Santander there are vehicles over 3.5 tonnes, being less prevalent Light Goods Vehicles (LGV), as in the case of Rome. This result is consistent with some traffic counts realized and again is related to that within the study area in Santander there are shops with sufficient size to require larger deliveries and therefore larger vehicles are used (because also permitted). This does not happen in the case of Rome, which also features road of its historic centre with narrow streets and limited space for parking, that push to the use of smaller size vehicles.

Table 10 – Vehicle types: revealed shares.

	Light Goods Vehicle *(less than 1.5 tons)*		***Medium Goods Vehicle*** *(1.5 to 3.5 tons)*		***Medium Goods Vehicle*** *(more than 3.5 tons)*	
	Rome	***Santander***	***Rome***	***Santander***	***Rome***	***Santander***
Foodstuffs	70%	15%	30%	52%	-	33%
Home Accessories	51%	22%	49%	60%	-	18%
Stationery	62%	47%	38%	47%	-	6%
Clothing	65%	68%	35%	32%	-	0%
Building Materials	35%	17%	65%	63%	-	20%
Household and personal hygiene	95%	65%	5%	35%	-	0%
Other	51%	23%	49%	62%	-	15%
Total *(average)*	**61%**	**37%**	**39%**	**50%**	**-**	**13%**

5. Conclusions

As happened in other European countries in the last years, the municipality authorities of Rome and Santander discovered the lack of data on urban goods movement. This has meant that in the two cities there are a great number of available freight demand surveys. Also, in case of Rome a model for urban freight demand forecast was specified and calibrated.

The surveys comparison has allowed us to point out a number of findings of great importance, although two case studies different from each other, both in size and economic structures. The study area in Rome is located in the historical centre of the city. In Santander, the study area corresponds to a typical medium-size city.

In relation to the freight demand, from retailers there are important differences that are strictly related to the size of cities. In Rome the freight transport is more structured with a low share of retailer transporting in own account. In Rome this share is about the 20%, while in Santander is about double. Another difference between Santander and Rome is relative to the average size of deliveries being higher in the case of Santander, in particular, in the foodstuffs category. The reason for this difference is that in the Santander study area there are larger shops requiring bigger deliveries than the other two cases. On the other hand, the distribution of freight for type, in the Spanish cities, follows a very similar pattern, while in Rome is also important categories like home accessories and stationary products (i.e. not daily consumption goods). Finally, the average quantity per employee is quite similar in Rome and Santander.

Regarding the results of surveys, we can conclude that is not possible to generalize results. We found that the quantity of goods produced present very similar ratios and therefore is an example of results generalizable and transferable. Not so with other aspects that depend heavily on the structure and size of the city and the regulation of distribution of goods.

Some sub-models have been calibrated in Santander following the same specification as the models developed in Rome. In relation to these sub-models we can conclude that is acceptable calibrate it based on the initial specification as the *attraction model* and *acquisition model*. In both cases the results show that all obtained parameters are statistically significant in both expected sign and validation statistics.

This result is related to the conclusion regarding the generalizability of the results of the surveys. That is, the models that determine the quantities of goods attracted by zone and estimates the origin-destination matrix of freights quantites, may be transferable between the two cities and, pending to extend this comparative analysis with other cities, could be perfectly generalizable and transferable models.

On the other hand, other sub-models do not have a degree of transferability so clear. This occurs, for example, in *transport service type model*, which in the case of Rome the model specification includes the origin of the goods (producer, distribution centre or wholesaler). This specification has not been possible calibrate for Santander. So does in relation to shipment size sub-model, which is mainly due to the structured and size of the study area.

There is a similar behaviour in relation to time distribution of freight, but some differences was found. This model is directly dependent regulation of timetables for goods distribution of each city, therefore its transferability depends directly of this aspect.

The last difference comes in both cities are the types of vehicles. In the case of Santander there are vehicles over 3.5 tonnes, being less prevalent light vehicles, as in Rome. This result is related to that within the study area in Santander there are shops with sufficient size to require delivery of larger size and therefore the use of larger vehicles.

In short, except for the models that determine the quantities of goods attracted by zone and estimates the origin-destination matrix of freights quantites, the other models we can not consider directly transferable, since they depend strongly on the structure, size and the regulation of distribution of goods of each city.

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