



Urban freight policies and distribution channels

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Abstract

Urban areas are vital centers of economic activity and innovation generating large economies of density and proximity. Yet, procuring and distributing goods in an urban context is fraught with difficulties because of infrastructure congestion, external costs, conflicting objectives among stakeholders, and asymmetric information.

In order to improve the performance of the urban goods transport system many policies have been proposed, including goods vehicle time windows, vehicle-type restrictions, loading/unloading policies, fiscal policies, the promotion urban transshipment and consolidation centres. Unfortunately, not much is known concerning how these policies affect the existing distribution practices. It is quite likely that the impact is differentiated by type of product and distribution channel. The aim of this paper is to explore this issue. Drawing on the existing literature and on the empirical evidence from some Italian cities, the paper identifies and discusses the relationship between each of the above-mentioned policies and the distribution channels of some goods (fresh food sold in retail stores, food distributed by Hotels, Restaurants and Catering (Ho.Re.Ca.), pharmaceutical products and clothing&footwear) which are commonly distributed in Italian urban centers. It is found that the distribution of pharmaceutical products is unaffected by these policies, whereas the distribution of fresh food is negatively affected especially by access time regulation and loading/unloading policies. The Ho.Re.Ca. and the clothing&footwear channels are likely to be impacted the most by fiscal policies and by the promotion of urban transshipment and consolidation centres.

Keywords: City Logistics; Goods movement; Vehicle routing problem.

1. Introduction

Urban areas are vital centers of economic activity and innovation generating large economies of density and proximity (Camagni, 2007). Yet, procuring and distributing goods in an urban context is fraught with difficulties because of several reasons.

Urban good distribution takes place in a context characterised by severe conflicts over the use of the urban space (between transport, recreational and economic uses, and

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between passenger traffic, freight traffic and parking) and over the use of scarce public goods such as air quality, noise, severance, safety. Such conflicts are regulated by city administrators and subject to continuous debate and negotiation among stakeholders. As a result the urban context is highly unstable.

Many actors are involved in the production and distribution chains: the producer, the wholesaler, the carrier (transport operator), the retailer and the consumer. Each has his own profit or welfare function¹. Hence, there are multiple decision makers and the information is distributed among spatially dispersed individuals. As a result urban goods distribution is often characterized by high transaction costs and asymmetric information.

Congestion, generated by limited infrastructure availability, and environmental impacts of transport are well-known sources of external costs inducing suboptimal private decisions.

Because of instability in the regulatory setting, high transaction costs, asymmetric information and external costs, urban goods distribution may fail to achieve, efficiently and effectively, its goals. Examples of such failures are suboptimal traffic congestion, excessive noise and air pollution, visual intrusion, insufficient safety, irregular parking, and good distribution inefficiencies.

The urban goods distribution issue has been extensively analysed by researchers. The concept of *city logistics* - defined as “the process of totally optimizing the logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy.” – has been proposed by Taniguchi et al. (2001) as a paradigm to approach the issue².

Many policies have been proposed to improve the existing urban good distribution system: regulatory policies, fiscal measures, land-use and planning measures, technological innovations, investment and practice innovations ((Visser et al., 1999; Maggi, 2007). In this paper we focus on five types of policies, frequently implemented by local authorities: goods vehicle time-access regulation, vehicle type restrictions, loading\unloading regulation, fiscal policies and the promotion of urban transshipment and consolidation centres. Their effect on the behaviour and on the decisions of private operators (shippers, carriers, and retailers) and, consequently, their impact both on the private logistic costs and on the social benefits are not easy to predict and, in our opinion, have not been sufficiently studied.

The purpose of this paper is, therefore, to contribute to the literature focusing on the impact of such policies on the distribution channels through which a good is made available at the retail point located in the urban area.

A distribution channel is a component of a supply chain. In general terms, a supply chain includes all firms that engage in activities that are necessary to convert raw materials into a good or service. A supply chain can be subdivided into a supplier

¹ For a theoretical analysis of the interaction among the main actors (seller, transporter, receiver) see Friesz et al. (2008).

² Logistics as a business problem is defined as “the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements” (Ballou, 1999). It is acknowledged that solving the logistic problem at a single firm level is not an easy task, since a firm is often made up by more than one person or department which need to share goals, motivations, abilities and information. At a supply chain level, involving more than one firm, the task is ever more difficult.

network and a distribution channel. There can exist multiple channels through which a good can be distributed to the consumers³.

An analysis of the data available for some Italian cities, reported in the next section, allows us to identify some goods whose distribution channels are of particular relevance. They are: fresh food sold in retail stores, food distributed by Ho.Re.Ca., pharmaceutical products and clothing&footwear. Hence, the paper is restricted to the illustration of the distribution channels for these goods, although several other goods, and distribution channels, can be found in an urban area.

The paper is hence organised as follows: Section 2 introduces the concept of a distribution channel and illustrates the main features of the distribution channels of the above-identified types of goods, with reference to the Italian case; Section 3 presents and discusses the potential of five types of frequently used urban freight policies; and, finally, Section 4 discusses the likely impact of each policy on each distribution channel. Section 5 draws some conclusions and proposes some lines of research.

2. Distribution channels in Italian cities

The supply chain of a product comprises all firms engaged in the activities necessary both to convert raw materials into goods, and to sell the products to consumers. Indeed, a supply chain can be subdivided into two parts: an upstream network including the firms that supply raw materials, components, parts, information, finances, and expertise to create the product, and a downstream network, called marketing or distribution channel, including the firms that make the product available for use to business users and/or consumers. Each member of the distribution channel adds value by bridging the time, place, and possession gaps that separate the producers of goods and services from their users. A supply chain might have multiple distribution channels (multichannel), a strategy generally used to reach different customer segments.

There can be many types of distribution channels, as illustrated in Figure 1. Short, or direct, distribution channels (n° 1 in the Figure), where producers sell goods or services directly to retailers or consumers. Long channels, characterized by intermediation activities performed by distribution centers owned by producers (n° 2), or by wholesalers (n° 3) (e.g. general wholesalers, single-line wholesalers, specialty lines wholesalers, drop-shippers wholesalers, truck wholesalers, cash and carry) or by agents and brokers (n° 5). If the production of the good is fragmented among many small firms, the producers can enhance bargaining power and increase logistics efficiency by joining in associations (or cooperatives) aimed at collecting and selling the product to the retailers (n° 4). Similarly, if the retail system is fragmented in many small firms, the

³ The need to analyse policy impacts differentiating by supply chains and distribution channels is supported by the literature (e.g. Maggi, 2007). Recently, Hensher and Puckett (2005), focusing on congestion charging, recognize that "A key element of the intersection between freight transport and traffic congestion is the role that agents in the supply chain can play in cooperating to change freight distribution activity. This involves a re-consideration of existing distribution networks (Chopra 2003) and ways in which we can design and activate collaborative process networks (Holmstrom *et al.* 2003).". Holguin-Veras (2006) underlies that the commodity type affects the decisions made by carriers and retailers in the contest of the choice between day and night deliveries. Similarly, Quak and de Koster (2006, 2007) and Browne *et al.* (2005) focus on how different supply chains are affected by time-access regulations.

retailers may join in associations or cooperatives (n° 6). Indeed, the complexity of the channels increases as the number of actors interacting along the distribution chain raises, implying, if channel members adopt mark-up strategies, higher management costs for producers and higher prices for consumers. However, a large number of intermediaries allows the producers to reach many target markets and the consumers to chose among broader assortments of products.

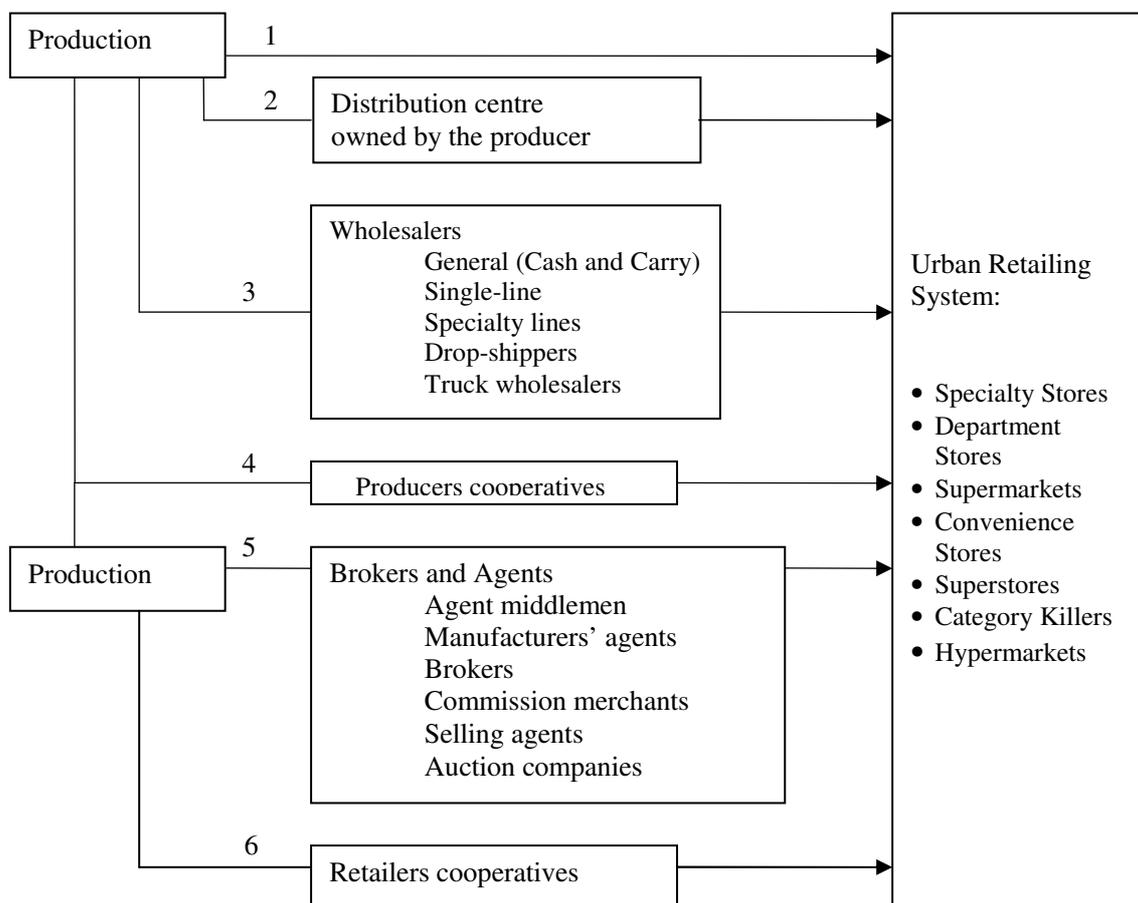


Figure 1: Distribution channels of a generic supply chain.
Source: Authors adaptation from Kotler and Armstrong (1999).

Boone and Kurtz (2001) show that the length of the distribution channel is influenced by several factors. An initial factor is the size and type of the market: if the end consumer is a firm that is geographically concentrated, buying large quantities of a product characterized by extensive technical knowledge and requiring regular service, such firm will be most likely supplied via a short channel. On the contrary, if the end consumer is a private individual, geographically dispersed, buying small quantities, incorporating little technical knowledge, and no extra service, that consumer will be supplied via a longer distribution channel. A second important factor is the type of product: if the product is perishable, complex or expensive, it is distributed via short channels, while if it is standardized, durable and inexpensive, it is delivered via longer channels. A third relevant factor is related to the characteristics of the producer and of its competitive strategy. If the manufacturer has adequate resources to perform promotion and delivery functions over broad product lines whose demand is

significantly influenced by the quality and quantity of promotion and marketing activities, the distribution channel will be short, and vice versa⁴.

A further important factor characterizing a distribution channel is represented by the transport and logistics activities that are performed by its members in order to transfer the products along the supply chain. The characterization of the transport and logistics activities is quite complex. It involves the description of at least the following features: a) the number of deliveries and collections at urban establishments; b) the pattern of goods vehicles activity at urban establishment by time of day, day of week and month of year; c) the vehicle type used to make deliveries; e) the vehicle dwell time; f) the loading/unloading process; g) the vehicle rounds and h) the percentage of own-account versus third-party operators⁵ (Allen et al., 2008).

2.1 Urban distribution channels. Evidence from Italian cities

What are the most important distribution channels in a city, and what are their main features? In the following sections, we provide an answer to these questions at least with reference to the Italian cities.

In Italy, there are only a few studies mapping both the distribution channels at urban level and their transport organization. A study conducted in 2004 in Mestre, a typical medium-sized Italian city located near Venice in the Veneto Region, reported that the most frequent retail activities in the central area are: Ho.Re.Ca. (30.3%), small specialized traditional stores (27.7%), clothing&footwear stores (13.8%), food stores (11.6%), home furnishing and electronics stores (7.7%), stationary and tobacco stores (5.4%), pharmacies (3.3%) and large retail organizations (0,2%) (Comune di Venezia, 2004). The retail system of the central area of Bologna, a larger-sized city located in the Emilia Romagna region, shows a similar structure since, according to a study performed in 2004 within the Cityport project (Regione Emilia Romagna, Assessorato Mobilità e Trasporti, 2005), the most common activities are: traditional stores specialized in products other than food (35.3%), Ho.Re.Ca. (30.3%), clothing&footwear stores (19.9%), and food stores (fresh, 10.6%; grocery 3.4%; frozen 0.5%).

In the city centre of Bologna the average size of these activities differs substantially by product type: it is small for fruit and vegetable stores (about 50 m²), intermediate for grocery stores (101 m²) and traditional stores specialized in products other than food (103 m²), and larger for HO.RE.CA. (116 m²), clothing&footwear stores (139 m²) and frozen food stores (196 m²). Most of the times, the inventory storing capability of these shops is quite small determining the dependence from frequent consignments.

Most of the distribution channels of Bologna have origin within the region (48%) or within the province (34%). The percentage of regional suppliers is very differentiated among retail segments, being as high as 95% for Ho.Re.Ca., and as low as 28% for traditional stores specialized in products other than food. On average, in Bologna, 63% of the suppliers of the retail system are producers, and 31% are wholesalers.

⁴ Sabbadini and Mungo (2009) acknowledge the importance of the last factor reporting on the propensity of the biggest Italian retail organizations to shorten their supply chains, thereby by-passing the existing intermediaries, using voluntary chains, corporate chains, retailer cooperatives, merchandising conglomerates, and franchise organizations.

⁵ This last feature is quite relevant since own-account services generally appear to have a lower loading factor, to perform suboptimal routing and to use more polluting vehicles than third-party services.

Freight transport represents an important share of total traffic. The percentage of vehicles transporting goods compared to the total number of vehicles entering in 1999 the Mura Aureliane of Rome between 7 a.m. ad 6 p.m. was equal to 12%. Such percentage is estimated as high as 67% during the morning peak hours (ISFORT, 2003).

In terms of percentage of consignments, in 2004 in Bologna, traditional stores specialized in products other than food have the largest share (42%), followed by Ho.Re.Ca. (18%), food stores (15%), and clothing&footwear stores (1%). Concerning the consignments frequency, in Mestre it was found that pharmaceutical products were delivered either once a day (60%), or more than once a day (40%), Ho.Re.Ca was supplied mostly on a weekly (60%) or daily (38%) basis, food stores were supplied mainly daily (68%) or more-than-once per day (16%), while clothing&footwear stores were supplied weekly (48%), on a daily bases (19%) or occasionally (14%).

The relative share of own-account vs. third-party transport is as follows: it is equal to 63% in the central area of Milan (Vaghi, 2009) and it was reported as high as 78% in other Italian cities. In Mestre the percentage of retailers owning a vehicle to transport the goods from the producers or the wholesalers to their premises is equal to 42%. More specifically, it is as high as 71% for Ho.Re.Ca., 58% for home furnishing and electronics stores, and 47% for food stores, while it is equal to 33% for clothing&footwear stores , and to 20% for pharmacies (Comune di Venezia, 2004). In Bologna the percentage of products transported into the central area via vehicles owned by the producers is equal to 82% for Ho.Re.ca, 77% for food stores, 57% other then food products, 11% for pharmaceutical products.

Own-account transport, hence, represents, at least in Italy, an important segment of urban goods distribution to which, as we will see, policy makers devote a fair share of attention. Such attention appears to be motivated since own-account proved to be far less efficient than third-party per unit of vehicle used. For instance, it is measured that the number of own-account vehicles entering the central area in Bologna is approximately equal to the number of vehicles owned by third-party operators, but the former makes half the consignments made by the latter.

Given the above information, we decided to focus our attention on the distribution channels of fresh food sold in retail stores, food distributed by Ho.Re.Ca., pharmaceutical products and clothing&footwear since they appear to be important traffic generators in Italian cities⁶. In the following sections we will describe their organization structure and their performance level. Our analysis will be based on a selection of indicators developed by Quak and de Koster (2006) integrated by some indicators that we propose. We will focus on: the type of distribution channels used by each supply chain to service the urban retail system, which actor along the supply chain acts as the logistic coordinator, the distance between the stores and the distribution centre, the percentage of stores located in central areas, the competitive strategy chosen by the retailers, the assortment of products offered by the retailers, the product value, the product volume, the consignment size, the delivery frequency, likely self-implied time windows⁷, the number of time windows, the degree of transport activities performed via own account, the type of routing chosen by the carrier, potential transport activities requiring special vehicles.

⁶ Similar results are reported by Dufour and Patier (1999) for Bordeaux.

⁷ A self-implied time window is the time window required by the retailer given staff availability or to separate the shopping public from the supplying activities.

2.2 Fresh food

2.2.1 Citrus, fruit and vegetables

In Italy there are four main distribution channels for citrus (Aguglia, 2008):

- a) *A short channel*: the producer sells its products directly to the consumers. It is typically used by small producers having no or limited logistic organization and directly taking care of promotion and delivery activities.
- b) *A long channel*: the producer sells its products to a wholesaler who trades them with large retail chains or corporations, small specialty stores, or final consumers. The wholesaler coordinates the entire distribution channel frequently providing also the transport service.
- c) *An integrated channel*: the producer sells its products directly to the retailer, no intermediation is performed by wholesalers, and the coordination of the distribution activities is performed by the producer or by the retailer according to their size and their logistic organization.
- d) *A logistic platform channel*: the retailers coordinate their supplying activities via purchasing groups, retailers' cooperatives or associations, and voluntary chains, who buy the products directly from the producers or from the wholesalers. The product is then collected in a logistic platform and transported by third parties operators.

The distance between the distribution centres and the retailers can be either short, as for distribution channel (a) and (c), or medium as in channel (b) and (d).

In Italy citrus represents 24% of the total sales of fruit. 45% is distributed by medium or large retail organizations (LRO, such as supermarkets, hypermarkets and hard discounts). The remaining is distributed via small specialty stores (25%) and fruit and vegetable stalls (23%). A significant proportion of the citrus bought by large retail organizations is sold to Ho.Re.Ca..

The distribution channels of fruit and vegetables in Italy are very similar to those already described for citrus. Large retail organizations hold 30-40% of the market share, while small specialized retailers and itinerant vendors have diminishing market shares over time.

The percentage of stores located in central urban areas is low (large retail chains or groups are generally sited in the peripheries of large urban areas), or medium (small specialty stores and itinerant vendors). While large retail organizations base their competitive strategy on product differentiation, low prices and quick response, small specialty stores and itinerant vendors are more quality and brand-oriented. The assortment type of large retail organizations is much more complex than the one characterizing small specialty stores and itinerant vendors (AGCM, 2007).

The product volume is generally small or medium, while the drop size depends on the retailer size. It is typically large for retail organizations or corporations, both because the turnover is much higher than for smaller stores and because their stocking facilities are larger, while it is medium for specialty stores.

The delivery frequency is high and the consignments are performed early in the mornings. The number of the delivery time windows is not flexible and the self-implied time windows are narrow.

The transport activities are performed by third-party operators for large retail organizations, generally via multi-dropping routing if the consignment for each store of the network is less-than-truck (LTL) load. Special refrigerated trucks are used for the transport activities especially if the distance between the distribution centre and the stores is long. Small specialty stores and itinerant vendors, instead, perform transport activities using their own vehicles because they prefer to personally check the assortment type and quality of the products offered by the wholesalers and they want to negotiate on the products' price.

2.2.2 Fresh fish and meat

The fish market is composed of two segments: the industrial fish segment (Figure 2) and the non-industrial (artisan) one (Figure 3). In the industrial fish segment, selling 390,000 tons annually, there are several distribution channels:

- a direct channel from the producer to Ho.Re.Ca., trading 5% of the total product;
- a producer-wholesaler-Ho.Re.Ca. channel, trading 31% of the total product;
- a producer-wholesaler-fish market-Ho.Re.Ca. channel, trading 5% of the total product;
- a producer-wholesaler-specialty store-consumer channel and a producer-wholesaler-fish market-specialty store-consumer channel, trading 26% of the total product;
- a producer-wholesaler-LRO-consumer channel and a producer-LRO-consumer channel, trading 26% of the total product.

Hence, the distribution channels of the industrial segment are multilevel and quite complex, and generally coordinated by the wholesalers. The distance between the distribution centers and the stores is medium or long.

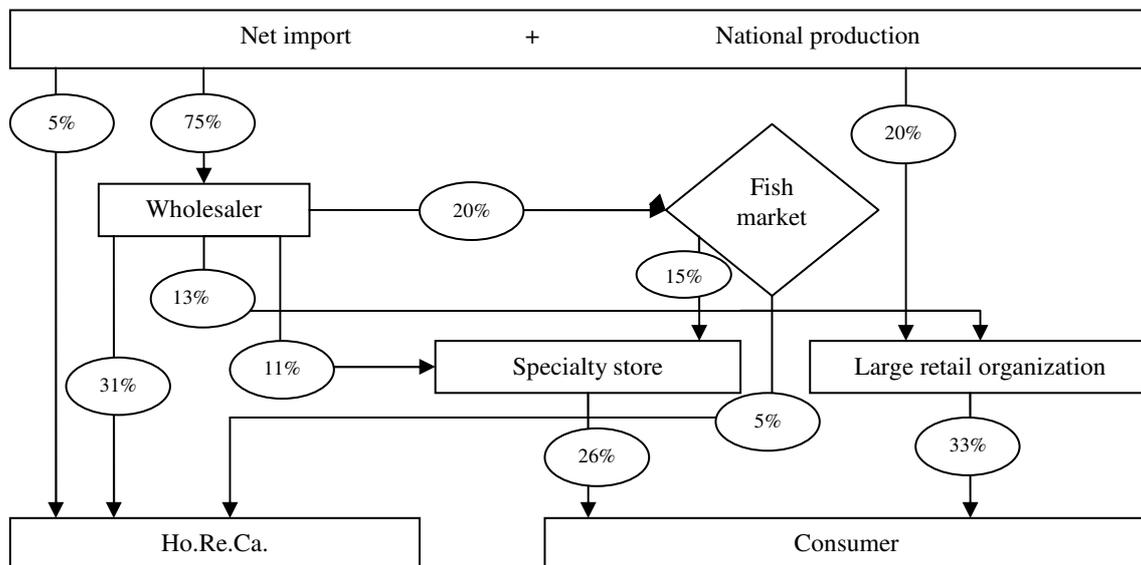


Figure 2: Distribution channels of the industrial segment of the fishing industry in Italy. Source: INDIS and Osservatorio Nazionale del Commercio (2006, p. 16).

Within the artisan fish segment, selling 100,000 tons annually, there are also several distribution channels:

- a direct channel from the producer to Ho.Re.Ca., trading 4% of the total product;
- a producer-wholesaler-Ho.Re.Ca. channel, trading 21% of the total product;
- a producer-wholesaler-fish market-Ho.Re.Ca. channel, trading 4% of the total product;
- a producer-wholesaler-specialty store-consumer channel, a producer-wholesaler-fish market-specialty store-consumer channel, and producer-specialty store-consumer channel trading 66% of the total product;
- a producer-consumer channel, trading 5% of the total product.

The main differences between the industrial and the non-industrial channel are that a) the coordination role is played both by the wholesalers and by traditional markets, b) the LRO plays no role since it does not find economically convenient to deal with very many small producers, and c) the short distribution channel is quite relevant (24%), being the sum of direct and intermediated by specialty stores only sales. The distance between the distribution centers and the stores is typically short.

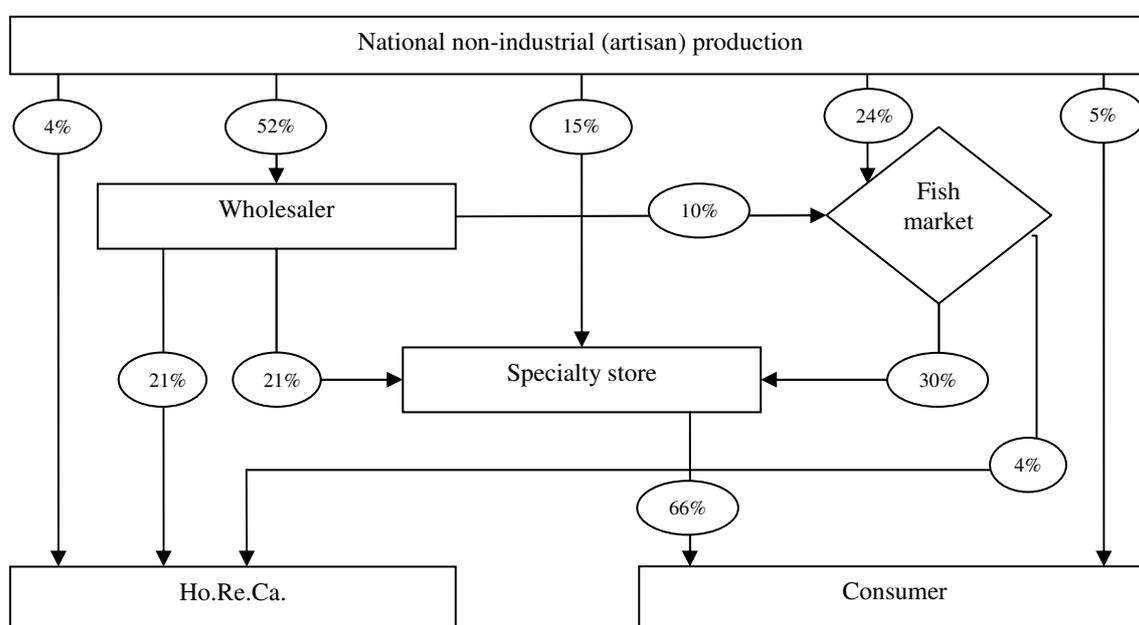


Figure 3: Distribution channels of the artisan segment of the fishing industry in Italy.
Source: INDIS and Osservatorio Nazionale del Commercio (2006, p. 17).

In Italy 114,500 tons of cattle and 450,000 tons of pork are traded annually in the meat industry.

The cattle distribution channel is quite complex. Compared with the previous ones it adds the following characteristics:

- wholesalers play a role also in procuring the product (7%);
- the slaughtering industry is the most important coordinator, selling directly to the food industry (15%), Ho.Re.Ca. (9%), the LRO (32%) and the specialty stores (25%) and indirectly via wholesalers (19%).

In the pork distribution channel, since the supply is more dispersed, wholesalers are the main suppliers of the slaughtering industry (63%). The slaughtering industry sells a

large quantity to the food industry (45%) and, again, to the wholesalers (27%). Then specialty stores and LRO distribute the product to the final consumer and Ho.Re.Ca.

The complexity of the distribution channels of this sector is due to the high number and the small size of all the actors involved (INDIS and Osservatorio Nazionale del Commercio, 2006).

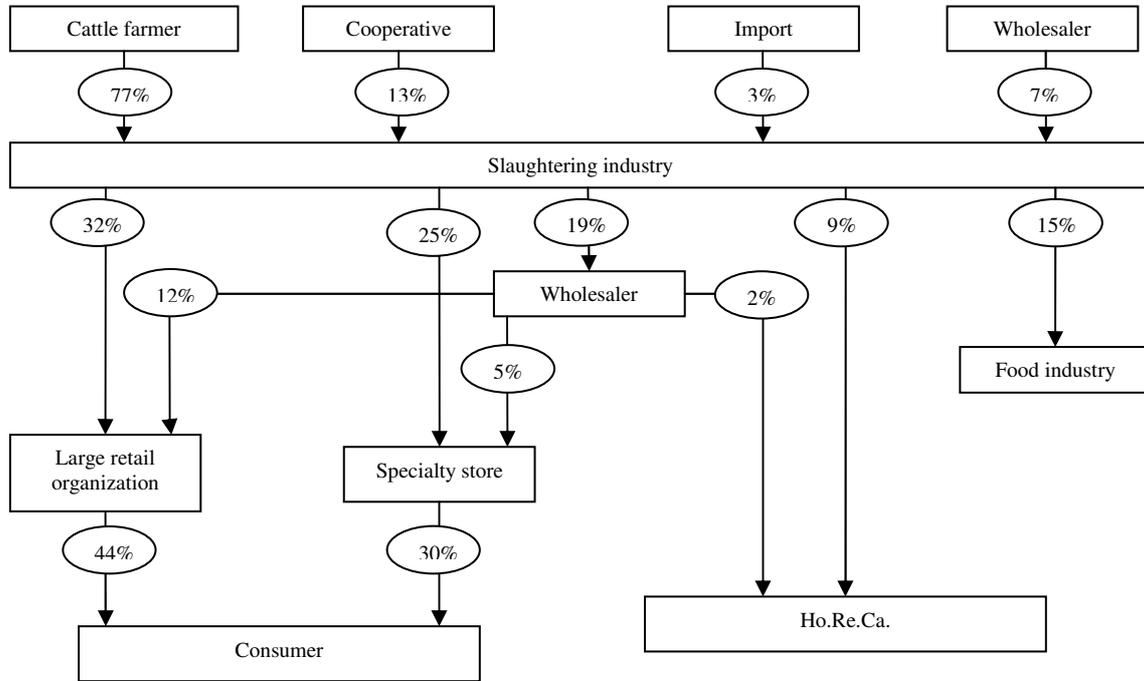


Figure 4 Cattle distribution channels in Italy.
Source: INDIS and Osservatorio Nazionale del Commercio (2006, p. 34).

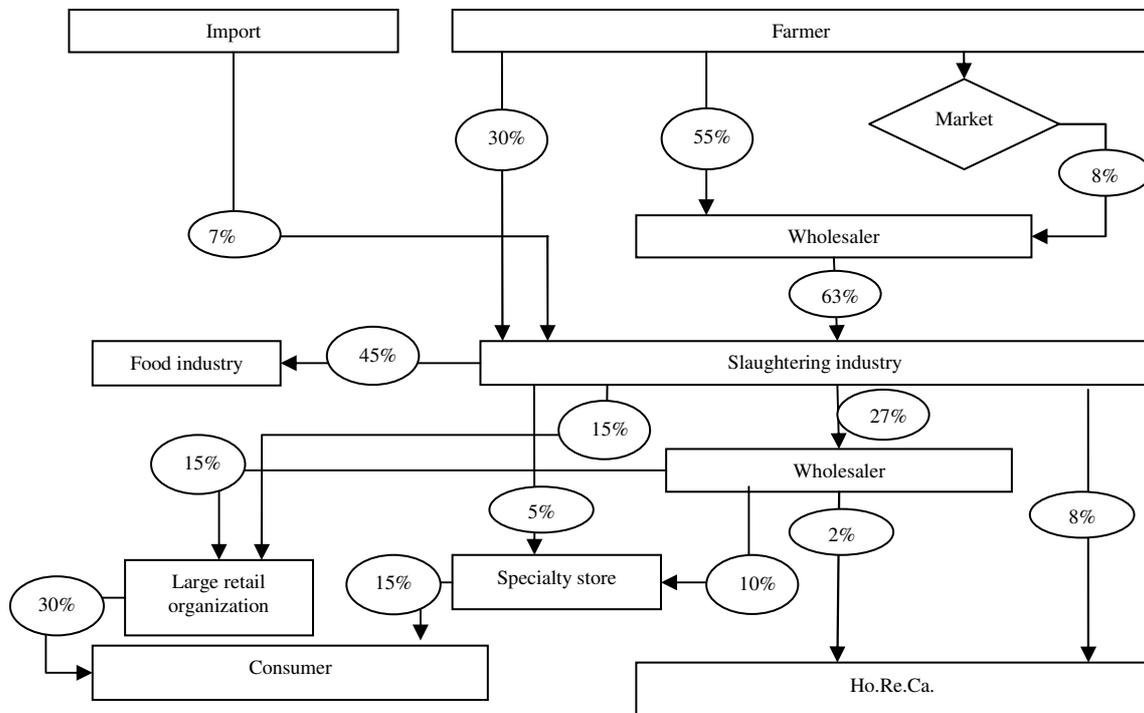


Figure 5 Pork distribution channels in Italy.
Source: INDIS and Osservatorio Nazionale del Commercio (2006, p. 38).

The distribution channels of the fresh fish industry and of the meat industry are coordinated, respectively, by the wholesalers and by the slaughter industry. In both cases their main functions are to group the small quantities of product offered by each producer and to ensure a broad assortment to final consumers, small specialized retailers, large retail organizations, Ho.Re.Ca., and the manufacturing industry.

The percentage of stores localized within the urban center is medium. The competitive strategy of the retailers is based on the origin and the quality of the product for small traditional stores, while it is cost-oriented and aimed at ensuring a standardized assortment level for large retail organizations. The assortment type is simpler for small specialized stores than for large retail organizations.

The product volume and the drop size is medium with high delivery frequency. The self-implied time windows are very narrow for small specialty stores, while they are wider for large retail organizations, although in both cases the consignments should to be done early in the morning.

The transport activities are performed using refrigerated trucks by third parties hired by wholesalers or via own account.

2.2.3 Dairy products

In Italy there are almost 46,000 firms producing milk and dairy products, although most of them are localized in the northern part of the country. Milk is transported and collected in centralized facilities (Centrali del Latte) generally owned by cooperatives of producers and localized near large urban areas. Here milk undergoes the pasteurization and the packaging process. It is then distributed to the urban retail system (Direzione Generale Agricoltura della Regione Lombardia, 2007).

Dairy products are distributed mainly via large retail organizations (59%) and only a marginal percentage is sold by traditional (13%) or specialty (6%) food stores, by hard discounts (5%), or by Ho.Re.Ca. (8%). The distance between the distribution centers and the stores is short or medium depending on the assortment type of the products sold by the retailers.

The percentage of stores localized in central urban areas is low (large retail organizations) or medium (small traditional stores) according to the retailer typology considered. The competitive strategy pursued by the retailers is based on product differentiation and quick response for large retail organizations, while it is brand-based for small traditional stores. The assortment type is complex for large retail organization, and it is simple for small traditional stores.

The product volume and the drop size is medium. The product is delivered on a daily bases during the mornings within narrow self-implied time windows.

The transport activities are organized via multi-drop consignments and are performed using refrigerated trucks generally owned by the producers' organizations (*Centrali del Latte*) or by the large retail organizations.

2.3 Hotels, restaurants, catering

The segment of hotels, restaurants, and catering (Ho.Re.Ca.) is generally described as an homogenous retail segment. However, its commercial activities present very different logistics and organizational constrains according to the specific service offered to the final consumers.

In Milan, most Ho.Re.Ca. is supplied by wholesalers, servicing 53% of the bars and 43% of the restaurants, or directly by the producer, supplying 21% of the bars and 15% of the restaurants (Cermes Bocconi, 2006). The so called cash&carry represents the preferred distribution channel for 13% of the bars and for 20% of the restaurants, while traditional food stores and local markets supply, respectively, 5% and 3% of the bars and 10% and 9% of the restaurants. The distribution channels chosen by Ho.Re.Ca. are extremely heterogeneous according to the product type. Own-account (cash and carry) is particularly relevant for liquors (45%), flour, sugar and salt (41%), preserved food (40%), cooked meals (35%), soft drinks (27%), that is for products whose replenishment can be planned in advance and that can be easily stored. The short distribution channel, instead, is preferred for coffee (68%), wine (43%), ice-cream (34%), and confectionery (31%). Bread (55%), pastry (33%), meat (28%), fruit and vegetables (22%), fish (22%), and dairy food (19%) are among the products more frequently purchased from specialty stores. Wholesalers are preferred when frequency, timing, and freight vehicle characteristics are critical issues characterizing the logistic activities, producer and specialty stores, instead, are chosen when quality is judged as more important, while cash&carry prevails if price and variety is particularly relevant.

The percentage of Ho.Re.Ca. activities are localized within central urban areas is quite high. Their competitive strategy is very heterogeneous and is based on differentiation, response or price according to the market segment they are focused on. The assortment type is simple and the product value is low.

The product volume and the drop size are small or medium. The self-implied time windows for the consignment operations are narrow, and restaurants and bar specialized in breakfast and lunches need to receive the supplies early in the morning.

When the supply channels are specialty stores or cash&carry the transport activities are performed by the retailer using his own vehicles, while they are performed by third-party operators or by agents of the producers when the suppliers are wholesalers or producers. Special refrigerated trucks are used for fresh or frozen food.

2.4 Pharmaceutical products

In Italy there is one main distribution channel for pharmaceutical products. It is founded on 230 pharmaceutical firms stocking their product in 150 distribution centres, delivering them via 138 wholesalers and almost 17,000 pharmacies (Figure 6, Dallari, 2006).

The distribution channels of the pharmaceutical products are four:

- a direct channel from the producer to the pharmacies (6%);
- a producer-distribution centre- logistic provider-wholesaler-pharmacy channel (78%);
- a producer-distribution centre- logistic provider- hospital (14%);
- a producer-distribution centre- logistic provider-wholesaler- hospital (2%).

The distribution channels are mainly coordinated by logistics providers and wholesalers. The distance between the pharmacies and the distribution centers are generally short, as each pharmacy is supplied by the nearest regional centre carrying the required product.

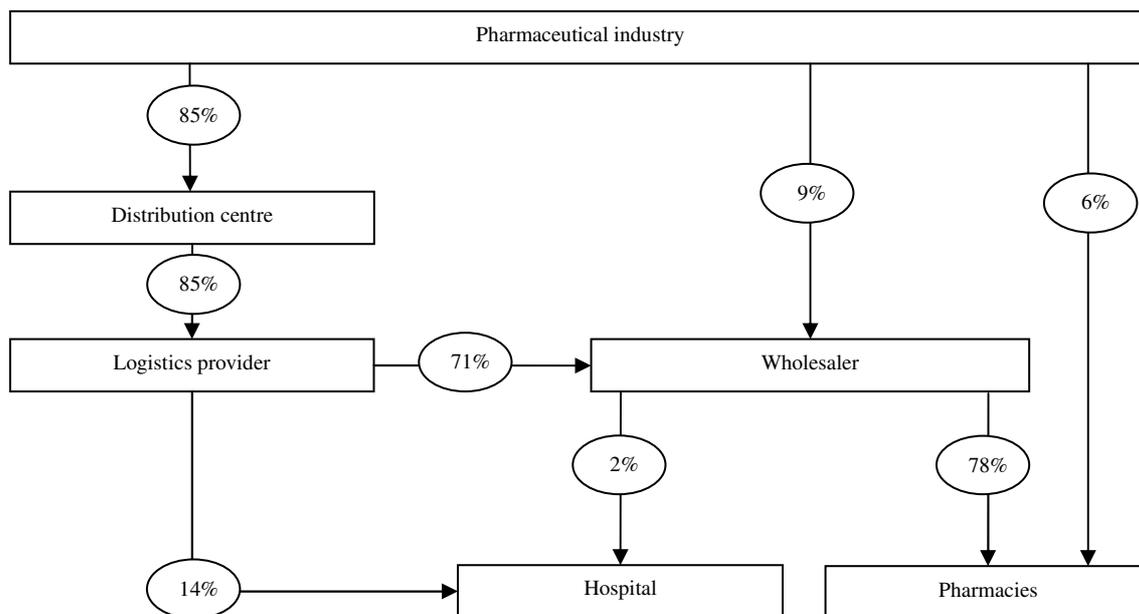


Figure 6 Pharmaceutical distribution channels in Italy.

Source: Dallari (2006, pp.8-9).

This distribution system is very effective because all the actors involved share the same electronic database with real-time listings of the quantity of products required by each pharmacy, and the availability of products stored by the wholesalers localized in their proximities. 80% of the information transmitted through this supply chain is sent on line via EDI (electronic data interchange) and Internet.

As the Italian regulation of this industrial sector requires a maximum of one pharmacy every 5,000 inhabitants for municipalities up to 12,500 inhabitants, and a maximum of one pharmacy every 4,000 inhabitants for larger municipalities, the percentage of pharmacies localized in central urban areas is quite small. The competitive strategy pursued by each pharmacy is based on responsiveness (the Italian regulation requires pharmacies to have a lead time under 12 hours), and product assortment. The externalization of the stocking activities to wholesalers and distribution centres allows the producers and the pharmacies to substantially reduce their costs, while the size of their intermediaries are rapidly increasing, allowing to better exploit economies of scale and to further reduce supply chain costs.

The complexity of the assortment type is such that, although the product volume is typically small, the quantities stored per product type are small and the delivery frequency is very high, up to 4 times a day, with an average lead time of 4 hours. The drop size is small and the delivery operations are performed on-street.

The transport activities are performed by third parties hired and paid directly by the wholesalers. They use refrigerated trucks and organize the deliveries via multi-drop routing supplying all the pharmacies within the city boundaries.

2.5 Clothing&footwear

In Italy there are four main distribution channels of clothing&footwear and differ according to the retailer type: 1) small traditional stores, which account for 51% of the turnover, and are particularly relevant for menswear and shoes; 2) itinerant vendors, which produce 15% of the turnover, and are quite popular especially for underwear; 3)

retail chains and corporations (17% of the turnover) and 4) franchising stores (17% of the turnover). The latter two are increasing their market share specializing their activities in sportswear, and in female and child clothing, respectively (Osservatorio Nazionale del Commercio, 2006).

These distribution channels differ substantially in terms of logistical organization. Indeed, while retail chains, corporations and franchising stores have a centralized logistic coordination supplying all the stores included in the network and based on centralized distribution centers, traditional stores and itinerant vendors lack any sort of logistic coordination, except for the transport service generally provided by the wholesalers during the replenishment period at the beginning of the winter and summer season and supplying more than one store during the same trip. The distance between the distribution centers and the stores can be quite long, especially for big retail chains or corporations or for highly geographically concentrated franchising organizations.

The comparison of the Italian retail system with those of other European countries (Germany, Spain, France and UK) shows that the Italian one is much more fragmented. Indeed, in 2002 in Italy there were 15 small clothes stores for every 10,000 inhabitants, while the proportion was equal to 3 in Germany and to 2 in UK. Similarly, in Italy there were almost 4 small footwear stores every 10,000 residents, while the proportion was equal to 1 in Germany and to 0.7 in UK (Osservatorio Nazionale del Commercio, 2006).

The percentage of stores localized in central urban areas is typically high. The competitive strategy of the retailers can differ substantially among the four distribution channels described at the beginning of this sections since it is typically cost-oriented for itinerant vendors and retail chains and corporations, brand-oriented for franchising stores, and differentiation-oriented for traditional small stores. The product assortment is generally complex and the product value ranges from low to medium according to the product type and brand sold by the retailer.

The product volume is small or medium, while the consignment size is large for seasonal orders concentrated during September/November and March/May, while it is small for stock replenishment.

The delivery frequency is low as the turnover of the stocked products is generally low. The retailers do not have stringent self-implied time windows, although they prefer to receive the deliveries during the mornings rather than during the afternoons, and are quite flexible in terms of number of time windows.

The transport activities are generally performed by third parties (express companies performing multi-drop or single-drop routing according to the size of the delivery and the location of the stores to be supplied) especially for the seasonal orders and when they transport hanging clothes using specially equipped vehicles. When the retailers are small, instead, the stock replenishment products are transported directly by the agent of the wholesaler or via own account.

2.6 Distribution channels in Italian cities: a comparative summary

In Table 1 we have summarized some characteristics of the types of products that, in our view, are among the most critical generators of transport and logistic activities in Italian urban centres.

The distribution channels used by each type of product are quite heterogeneous and range from the homogeneous, highly efficient one used for pharmaceutical products coordinated by a logistics provider, to the less efficient, multichannel systems used for

the other products. Not at all distribution channels have a logistics coordinator. There appears to be a lack of coordination in some segments of the small commercial activities selling clothes or fresh food and part of Ho.Re.Ca.. The distance between stores and distribution centres is short for pharmaceutical products and Ho.Re.Ca., long for clothing&footwear and ranges from short to medium for fresh food.

Table 1: Characteristics of the distribution channels of four types of products.

	Fresh food	Ho.Re.Ca.	Pharmaceutical products	Clothing & footwear
Logistics coordinator	Wholesaler, slaughtering industry, milk factories, no coordination	Partly the wholesaler, no coordination	Logistics provider	Franchising firms, producers, no coordination
Distance between stores and DC	Short, medium	Short	Short	Long
% of stores in central areas	Low, medium	High	Low	High
Competitive strategy	Differentiation, cost, response, brand	Differentiation, cost, response	Response	Differentiation, cost, brand
Assortment type	Simple, complex	Simple	Complex	Complex
Product value	Low	Low	Low	Low, medium
Product volume	Small, medium	Small, medium	Small	Small, medium
Drop size	Medium, large	Medium	Small	Small, medium
Consignment size	Highly variable size due to product and retailer type	Small but variable due to receiver specificity	Small parcels, high frequency, quick response	Variable size due to seasonal orders versus stock replenishment
Delivery frequency	High	Medium	High	Low
Self-implied time windows	Narrow	Narrow	Wide	Medium
N° of time window	Not flexible	Flexible	3-4 a day predefined	Flexible
Own account	Yes: for Specialty Stores	Yes: for Specialty Stores, and C&C	No	Yes: for Small Stores
Routing	Both multi-drop and single-drop	Both multi-drop and single-drop	Multi-drop	Both multi-drop and single-drop
Special vehicle	Yes	Yes for perishable or frozen food	Yes	Yes for hanging cloths

At supply chain level, the number of stores localized within the urban centre over the overall number of stores localized in the urban area is higher for clothing&footwear and

Ho.Re.Ca., than for fresh food and pharmaceutical products. The competitive strategies pursued by pharmacies are based mainly on response, hence, requiring an efficient and highly integrated logistics organization. On the contrary, the competitive strategies of the other products are much more heterogeneous including differentiation, brand, and cost. This hinders their integration and efficiency levels.

The assortment type (i.e. the variety of goods distributed) is complex for pharmaceutical products and clothing&footwear, whereas it is often simple for Ho.Re.Ca. and fresh food, although it depends on the type of retail activity considered. None of the analysed supply chains trade high value products, except for some clothing segments (boutiques). The product volume and the drop size are very small for pharmaceutical products, small or medium for clothing&footwear (could be large for the seasonal orders) and Ho.Re.Ca., and medium or large for fresh food (depending on the product type and on the retailer size).

The delivery frequency is very high for pharmaceutical products, high for fresh food, high or medium for Ho.Re.Ca. and low for clothing&footwear. The self-imposed time windows are particularly narrow for fresh food and Ho.Re.Ca., while they are less stringent for pharmaceutical products and clothing&footwear. The number of self-imposed time windows is 3-4 a day for pharmaceutical products, variable for clothing&footwear and Ho.Re.Ca. (except for bars serving breakfast and lunches) and limited to the early mornings for fresh food.

Pharmaceutical products are supplied exclusively via third party operators, hence, with higher levels of efficiency, whereas the other products are distributed also via own-account transport. The latter is used for clothing&footwear in the case of the stock replenishment and for Ho.Re.Ca. for products bought from cash&carry or specialty stores. Own-account transport prevails in the acquisition of fresh food sold by small traditional stores.

Special refrigerated vehicles are used for pharmaceutical products, fresh food and Ho.Re.Ca., whereas clothing&footwear require special vehicles only when transporting hanging cloths.

3. Urban freight transport policies

In the following paragraphs five specific, frequently implemented, urban freight transport policies will be examined: goods vehicle time-access regulation, vehicle type restrictions, loading\unloading policies, fiscal policies and the promotion urban transshipment and consolidation centres.

Other relevant policies such as public-private partnerships, information and communication technology (ICT), Intelligent transportation systems (ITS) and land use planning will not be discussed in this paper not because they are not relevant but in order to limit the scope of the paper.

In the next subsections some information will be provided on how each of the five policies has been implemented and on what are their main effects.

3.1 Goods vehicle time-access regulation

Local authorities increasingly use time-access regulations. Quak and de Koster (2006, p. 6) quote a survey among the 278 largest municipalities in the Netherlands showing that the proportion of municipalities that use time-window regulations increased from 41% in 1998 to 53% in 2002.

The general aim is to improve social sustainability, such as the attractiveness of the city centre. More specifically time-access regulations aim at: a) improving the shopping climate by separating the shopping public from the suppliers; b) reducing the perceived impacts of trucks on congestion during certain periods of the day; c) increasing pedestrian safety or d) reducing the nuisance caused by urban freight transport especially during nighttime or the early morning hours.

The variety of aims leads, not surprisingly, to a variety of implementations. Browne *et al.* (2007) find that “in London they are in many ways the reverse of those in Paris”: London restricts night deliveries but does not regulate day restrictions, whereas Paris regulates day restrictions. In fact, in London “the objective of the scheme is to reduce noise nuisance at anti-social times by eliminating through heavy lorry traffic at nighttime and weekends and minimizing the environmental intrusion of heavy lorries with business in London during the ban period.” (Browne *et al.*, 2007, p. 213)⁸. In Paris the regulation is under revision, however, it seems more focused on avoiding the intrusion and congestion caused by large vehicles on city livability and traffic⁹.

Analyzing the application of the regulation in Italian cities, one also finds highly differentiated regulations. Some cities prefer to restrict access late in the morning and early in the afternoon to favor tourism (Ferrara, Parma, Siena, Ravenna, Vicenza); others prefer to restrict access during the morning peak (Piacenza, Parma, Rimini); others distribute restrictions all day long (Bologna, Roma, Firenze, Lucca); some cities differentiate access restriction between third-party and own-account vehicles (Rome, Florence, Bologna) (see Cityports, 2005; Maggi, 2007).

Not much is known about the actual effects and costs on these restrictions on the supply chain operations. Valuable exceptions are Quak and de Koster (2006, 2007), Browne *et al.* (2005), and Holguin Veras (2007a, 2008).

Quak and de Koster (2006) evaluate five different time-window schemes regulating access in Dutch cities and find that the current time-window scheme (5 hours 20 minutes in the afternoon) performs worst and show how a reformed, more harmonized, policy could decrease costs. The effect also seems to depend on the number of regulated cities. In fact, they conclude that “it appears that cost and emissions increases are moderate, when few cities are affected. However, as more cities are affected, costs and emissions increase considerably, particularly if time-window lengths become shorter. Time-windows harmonized between cities lead to fewer negative effects.” Quak and de Koster (2007, p. 1103). This implies that central governments might have an important role in guiding regulation.

⁸ Browne *et al.* (2007, p. 214) report that “The LLCS aims to ease traffic noise in residential areas by restricting lorry movements (for goods vehicles over 18 tonnes gross weight) on designated roads during the night (21.00–07.00) and at weekends (13.00 on Saturdays through to 07.00 on Mondays).”

⁹ Browne *et al.* (2007, p. 213) report that “Under the new scheme, goods vehicles up to 29m² (i.e., rigid goods vehicles with gross weights of up to approximately 19 tonnes) are not allowed to enter the Paris area between 17.00–22.00 but can enter at all other times. Goods vehicles over 29m² are only allowed to enter between 22.00–06.00.”

Besides analysing what the likely impacts of time-access windows on a retailer's financial and environmental performance will be¹⁰, Quak and de Koster (2007) discuss which dimensions related to a retailer's network structure and logistical planning will determine its sensitivity to time-windows. They focus on various retailer characteristics (product characteristics, network structure, logistical planning) and distribution performance (operational, financial, environmental). Since they use fourteen cases, the sample is too small to consider any statistical analysis. However, they conclude that the impact of increasing time-window pressure varies among different retailers. The retailers that supply more stores during the time-window hours - thanks to the short distance, short unloading time, and larger drop size - are affected the least. On the contrary, the retailers which use their vehicles most during a 24-h period in the current situation are affected the most by time-windows.

Browne *et al.* (2005) raise the question of whether the night-delivery curfews currently imposed by many local authorities are inappropriate or too severe. They argue that time restrictions will lead to a situation where more vehicles are required in the delivery, there is less productive output from drivers since they have to deliver when traffic levels are high, and lastly, more fuel will be used as consumption increases in more congested areas. On the contrary, a removal/relaxation of the policy could improve efficiency of operations and improve sales, allow faster and more reliable journey times with a potential reduction in social and environmental impacts of truck trips. However, it may also result in noise disturbance for the people living close to the point of delivery due to the engine and unloading noise. They analyse the relevant UK and European literature to produce estimates of the cost and freight activity reduction that would result from removal of the restrictions and support the view that there will be both costs and benefits. The challenge is to find an acceptable way to measure them and to identify in which instances there could be a positive benefit-cost ratio. It was also observed that the type and location of retail shops is diversified and that the policy is more appropriate for shops situated at the edge of urban areas than for urban or central shops located nearby residential areas.

In a series of papers Holguin Veras (2007a, 2008) analyze the potential for night delivery as a way to decouple passenger traffic peaks from freight traffic peaks using stated preference data and discrete choice modeling. Holguin Veras (2007, p. 294) finds that the retailer decides the time of the consignment and "that carrier centered policies, working in isolation, are of limited effectiveness to switch truck traffic to the off-peak hours. This is because: not all the carriers can pass the extra costs to receivers; and, more importantly, even when extra costs are passed they are of no consequence with respect to the marginal costs to receivers associated with accepting off-peak deliveries." Holguin Veras (2007) also studies the financial incentives that might induce retailers and carriers to shift to off peak periods. He finds that "receivers are sensitive to the financial incentives considered in this research. However, different industry segments were found to be more sensitive than others. Receivers of wood/lumber, alcohol, paper, medical supplies, food, printed materials and metal are found to be between two to eight times more sensitive than the rest of the population of receivers." (Holguin Veras, 2007, p. 294). The commodity type plays a significant role in shaping the attitude of companies towards off peak deliveries for carriers as well "only specific segments of

¹⁰ Quak and de Koster (2006a,b,c, 2007) use the term retailer to identify retail chains with many stores in multiple cities. All retailers organise the entire logistics and manage directly or via contracted third party carriers the transportation operations.

the carrier industry are sensitive to the type of financial incentives considered.... only carriers transporting wood/lumber, food, textiles/clothing, petroleum/coal and computer/electronics are sensitive to toll savings or financial rewards.” (Holguin Veras, 2008, p. 353). It remains to be assessed why different retailers and carriers behave differently.

3.2 Vehicle restrictions

In order to curb congestion and pollution, cities often regulate vehicle access according either to their dimension, weight, loading factor, and emission factor or fuel type.

The limits of the truck dimension or the weight dimension are aimed at decreasing congestion, road occupancy and the large emissions of air pollutants that characterize large trucks.

As in the previous case, in real world applications one can find a high variability of restriction limits. For instance, Paris restricts access according to vehicle dimension (16 m² or 24 m²) Amsterdam does not allow trucks heavier than 7.5 tons, London than 16 tons, Barcelona than 16.5 or 3.5 tons, Milan than 15 or 3.5 tons.

A potential side effect is the reduction of the consolidation possibilities. More small trucks can have the same or even more negative effects compared to fewer large trucks, as McKinnon (1999) has demonstrated in the context of the evaluation of the transshipment option. The same argument is put forward by Holguin-Veras (2006, p. 4-5).

An important element in judging the efficiency of road transport is the load factor¹¹ and the policies that induce its improvement. It is estimated that in the UK, for example, average load factors declined from 63% in 1990 to 60% in 1999. It is often argued that replenishing supplies on a just-in-time (JIT) basis corresponds to decreasing vehicle load factors¹², however one also observes that average payload weight actually increased. According to McKinnon (2000) improving vehicle loading can enhance energy and environmental efficiency of road transport. Increasing truck load factor is estimated to have larger energy saving effects than doubling rail freight traffic McKinnon (2000, fig. 2). This is true both for intercity and for urban traffic¹³.

One of the policies which can enhance load factors is the relaxation of maximum vehicle weight limits, hence showing a potential contrast between the policies. Other policies include: redesigning of vehicles to permit greater load consolidation (e.g., by compartmentalization of trucks to allow different temperatures); using of more space-efficient handling systems and packaging; organizational improvements such as the adoption of more transport-efficient order cycles such as the adoption of the Nominated

¹¹ Measured as the ratio of the actual weight of goods carried to the maximum weight that could have been carried on a laden trip.

¹² McKinnon (2000) quoted numerous reasons for declining freight density: change in the nature of the products; increased packaging; greater use of unitized handling equipment; declining “stackability”; order-picking of palletized loads at an earlier stage in the supply chain; tightening health and safety regulations.

¹³ As explained by McKinnon (2000) the load factor is only a partial measure of vehicle utilization. As an exclusively weight-based measure, it takes no account of the use of vehicle space or deck area, or the proportion of vehicle kilometers run empty. Many low-density products fill the available vehicle space (or “cube out”) long before the maximum permitted weight is reached. In sectors characterized by low-density products, weight based load factors tend to underestimate the true level of utilization.

Day Delivery System¹⁴ and abandoning the monthly payment cycle or by sharing vehicle capacity.

In the context of urban goods distribution some cities tried to introduce load factor requirement to enter the city centre. A recent example is Göteborg where a pilot project was initiated up, within the START European project, with the aim to develop the environmental zone with three new areas identified for load factor restriction implementation. The restrictions were implemented in parallel with a number of incentives developed in cooperation with the transport business. To access different parts of the centre the weight or volume load rate in the vehicles had to be over 65 % or the company had to have 50 customer deliveries. As incentives for increasing the load rate, the participating companies had access to 13 special loading zones and bus lanes in the city centre. The project was carried out according to plan but the results were not as expected. After one year many of the companies had left the project since they could not fulfill the load factor demands and/or reporting obligations. An independent evaluation showed that the compliance with the scheme was considered too complicated and too time consuming. This resulted in a termination of the pilot project in September 2007 (START, 2008, p. 27).

There is not much research on the effect of these restrictions on freight transport operations and costs. Exceptions are Allen *et al.* (2003) who found that the effect depends on the size of the fleet and the width of the serviced area. Quak and de Koster (2006b) also find that the use of the vehicle weight restriction results in decreased transport efficiency and, in almost all cases, in a considerable increase of pollutant CO2 emissions.

One likely effect on carriers is an incentive to fleet renewal. The effect is likely to vary depending on the lifespan of vehicles, the size of the fleet and the area to which the restriction applies relative to the serviced area.

An example of regulation based on emission factors is the one implemented in Milan with the Ecopass policy (Rotaris *et al.*, 2009) where a truck is taxed according to its EURO emission standard. Similarly, cities can introduce low emission zones (LEZ). A survey carried out in London by Browne *et al.* (2005) prior to its introduction indicated¹⁵ that there was some support among goods vehicle operators, depending on the precise scheme definition. Operators would generally try to comply with LEZ regulations, with most companies either using technical approaches to ensure that their London vehicle fleet complied with the required emission standard, or redeploying vehicles with the appropriate emission standard from other locations.

3.3 Loading\unloading policies

With a given number of parking spaces available there exists a competition between passenger and freight parking needs. It is not uncommon that loading\unloading (l\u) bays are used by a car, temporarily or for longer spells of time, as a solution for missing car parking spaces. In Paris survey work has demonstrated that l\u bays are occupied by illegally parked vehicles for 47% of the time, are empty for 47% of the time and are used by goods vehicles for collections and deliveries for only 6% of the time (Mairie de

¹⁴ With the Nominated Day Delivery System the delivery day predetermined either by the seller or by the buyer.

¹⁵ The LEZ operates in London 24 hours a day, seven days a week, including weekends and public holidays.

Paris 2006, quoted by Browne *et al.* 2007). In Bologna Dezi *et al.* (2008) find that 14% of the goods vehicles parked legally (2% in private lu bays, 7% in public lu bays and 5% on available parking spaces) and 86% illegally. Lu bays in Bologna are deemed insufficient. When goods vehicles drivers are asked why they did not make use of loading bays, 8% say because it was used by other goods vehicles, 6% because too far, 29% because not existing and 57% because occupied illegally by cars.

Signalling and enforcement is hence an important issue to solve. City authorities need to determine how many lu bays to make available for freight distribution and where and how exactly in the road to position them. The German city of Düsseldorf has experimented with some success the introduction of differentiated bays for smaller and larger trucks, the use of special signals and road marks, and positioning the bay after a bus stop or just before a turning street (VCD, 2006).

The practice of regulating goods loading and unloading in Paris and London is discussed in detail by Browne *et al.* (2007). Loading bays need both to be protected and strictly regulated in their use. In London a Code of Practice has been jointly developed by a wide range of stakeholders that includes Transport for London, London boroughs, trade associations and companies 'to promote best practice amongst business, local authorities and parking enforcement contractors to find effective solutions where loading/unloading is an ongoing problem' (FTA 2006).

Although carriers are the more affected by the difficulties in lu because of the longer lu times, receivers are indirectly affected as well. Marcucci and Danielis (2008) estimated via a stated preference study that the distance from the lu bay is a relevant factor in choosing the distribution technique. An increase in the lu bay distance from the shop from 0 to 100 metres for own account users is estimated to have a large increase (from 25% to 75%) on the probability of using an urban distribution centre and having the good delivered by a third-party.

3.4 Fiscal policies

Fiscal policies comprise both taxes and subsidies. Taxes could be imposed as congestion charges or area licensing and can be defined accordingly to vehicle type (load factor, size, Euro emission standard), and/or to time window.

There are a few examples of congestion pricing in European cities (London, Stockholm, Milan) involving urban freight transport. In London a goods vehicle which enters the congestion charging areas pays a fee equal to £7. There has been a debated whether to ask goods vehicles to pay more or less than cars. Eventually, it was decided to make them pay the same amount.

In Milan, vehicles are charged according to their Euro emission standard. Goods vehicles Euro 0, 1 and 2 are charged €10 and diesel-fuelled goods vehicles Euro 3 are charged €5. Rotaris *et. al.* (2009) estimate that in Milan freight transport carries a large share of the tax burden ("13% of the vehicles pay 42% of the charge", p. 10). A cost-benefit analysis shows that freight transport is a net loser since the tax it pays is larger than the benefits it gets from congestion reduction.

In Italy, area licensing is quite differentiated among cities and according to fuel type and third-party versus own account transport, as reported in table 2.

Table 2: Regulation to enter the LTZ for goods distribution.

City	Own-account		Third-party	
	Patrol- or diesel fuelled vehicles	Low emission vehicles (electric, LPG, methane)	Patrol- or diesel fuelled vehicles	Low emission vehicles (electric, LPG, methane)
Reggio Emilia	309.87 €/year If parking in \U bays in allowed times	Free-of-charge: electric vehicles	309.87 €/year If parking in \U bays in allowed times	Free-of-charge: electric vehicles
Parma	30 €/month	Free-of-charge: electric vehicles	30 €/month	Free-of-charge: electric vehicles
Ferrara	100 €/year 2 hours a day	20 €/year 2 hours a day	50 €/year 7 hours a day	10 €/year 11 hours a day
Cesena	155 €/year Free during the time windows	Free-of-charge	155 €/year Free during the time windows	Free-of-charge
Rome	565 €/year Unless transporting: medicines, perishables, valuables, printed matter	Electric vehicles: 300 €/year methane, LPG: 432 €/year	565 €/year Unless transporting: medicines, perishables, valuables, printed matter Free during the time windows	Electric vehicles: 300 €/year methane, LPG: 432 €/year Free during the time windows
Florence	90 €/year, no time limits if located within the LTZ 65 €/year, if located within the LTZ limited to 2.5 hours a day	Free-of-charge: electric vehicles	90 €/year, no time limits	Free-of-charge: electric vehicles

Fonte: PROGETTO CITY PORTS Rapporto Intermedio (2005)

The rationale for such a differentiation is not completely clear and it is probably based more on political compromise than on economic or efficiency improving reasons.

An important issue with fiscal policies is who bears the cost. The carriers who pay the charge or are they able to pass it on along the supply chain to the retailer/consumer or producer? McKinnon (2006) reports that according to a survey commissioned by the German government after the first 6 months of the German heavy goods vehicles tax (the Maut) the vast majority of hauliers had been able to pass on most of the toll to shippers. Many have had difficulty, however, recovering the tolls incurred on empty journeys, which in intercity freight transport represent, on average, 11% of autobahn truck trips. He also states that the hauliers' ability depends on whether the carriers carry less-than-truck load (LTL) or truck-load (TL).

Not much is yet known on the effects of charging. Tokyo Metropolitan Government conducted a survey to interview managers of trucking firms. It resulted that both small and large commercial trucks would reduce truck use. This would be achieved with more efficient fleet management and co-operative delivery system. It also resulted that road pricing would affect private (own account) trucks with relatively low loading factors

more significantly. It implies that cargo would shift from private trucks to commercial (third-party) ones to some extent (Browne, 2004).

As it appears, affected the most by congestion are the supply chains with cross-dock policies, JIT arrangements (fresh products, pharmaceutical products), small inventory, lean production, booking-in systems. More efficient supply chains, hence, are more affected by congestion. According to Holguin-Veras (2006, p. 6), for-hire carriers are less sensitive to tolls because they have less flexibility to change time of delivery, hence, they cannot avoid to pay the toll.¹⁶

It is quite unlikely that fiscal policies could be the solution to freight management demand in urban areas, although it could be part of the solution. The key reason - according to Holguin-Veras (2006, p. 1) - is “that the price signal reaching the receivers is too weak to be effective” and that there exist “market imperfections of various kinds, contractual constraints, and, more importantly, interactions between agents that dampen the effectiveness of the price signals.”.

3.5 Urban transshipment and consolidation centres

The introduction of urban transshipment and consolidation centres (UTCC) is an appealing policy aiming at changing the quantity and quality of deliveries. Many cities, mainly in continental Europe (Germany, The Netherlands, France, and more recently, Italy) have conducted studies, trials and experimented specific schemes. In 2008 the Italian government financed 4.8 million euro UTCC schemes in the Italian cities of 18 Italian cities. Yet, their results have been so far disappointing. Only in few cases the UTCCs survived financially without public subsidies or strong political commitment.

Woodburn, A. (2005) argues that UTCCs suffer from: a) lack of clarity of definition and scope, b) little overall analysis of factors contributing to success or failure, particularly from supply chain perspective, c) lack of evidence-based information about scheme viability which requires more evaluation in order to establish what actually works.

McKinnon (1999), examining the case of urban transshipment, finds that the term transshipment is rather vague. In fact, it can involve both disaggregation and consolidation of straight transfer of loads. He claims that the disaggregated/break-bulk form of transshipment would be costly and yield questionable environmental benefit, particularly if combined with tight vehicle size/weight restrictions. A much stronger economic and environmental case can be made for the consolidation of loads, even where this involves the use of larger/heavier vehicles. He also states that it would be difficult to justify investment in new transshipment depots, because (1) there are already in and around urban areas large amounts of distribution/warehouse space that could be more effectively used for break-bulk/consolidation operations and (2) it would be difficult for them to generate sufficient traffic to operate viably.

The more convincing success story is the Excel UTCC at Heathrow. It opened April 2001 with a 25000 square feet warehouse on the south east perimeter of the airport. It is characterized by multi-temperature operation, operational 24 hours per day, 7 days per week, 365 days of the year. It consists of 8 delivery areas (Landside and Airside in 4

¹⁶ In a survey, Holguin-Veras (2006, p. 7) find that “72.3% of for-hire carriers cited cannot change schedule due to customer requirements while approximately 61% of private carriers reported the same reason. It was also found that a larger proportion of for-hire carriers (21.2%) transferred costs to their customers, compared to 16.3% for private carriers.”.

terminals), a “Shuttle” based delivery schedule with fixed timetable, visiting each delivery area 4 times per day. Returns service is offered as part of the overall service. It includes cardboard collection and recycling service and delivery is made direct to store and unloaded into stockroom. According to (Foster, 2005), it is advantageous both for the British Airways Authority, for retailers, for suppliers and for the environment¹⁷. Financially, it turned out to be a success due to large volume that creates a critical mass for efficient operations and the old design of the airport which results in small space available. Furthermore British Airways Airport controls the airport area and it is therefore easy for them to impose the logistic scheme. With consolidated deliveries and pickups much less space and much less loading bays are needed (8 instead of 64). The cost is shared by three parties. Firstly, retailers make contribution to the construction. Secondly, retailers pay additional money for any special service they want. Thirdly, British Airways Airport got subsidies from government. The cost is not the construction cost but also the management cost.

The relevant question is whether this success story can be transferred to ‘off-airport’ practices such as city center.

Dablanc (2005) discussing the French experience with UTCCs underlines that one of the difficulties is financial: UTCCs need high subsidies from municipalities. For instance, in La Rochelle the production costs are estimated to be 3.8€/parcel whereas price asked to UTCC users is 1.7€ (2001). Similarly, in Monaco the production costs is 3€ (2002) and the price asked to customers: 2.30 €/100 Kg, Monaco Logistique receiving 2.59 €/100 Kg as a subsidy.

Furthermore, according to Dablanc (2005) transport companies are reluctant to use them, their official reason is the fear of unequal competition, but they also consider UTCC prices too high (see example of Basel below) and prefer to continue to subcontract transport to small transport companies. This is also the results of the fact that municipalities do not enforce strict traffic/delivery regulations.

Other explanations to UTCCs failures listed by Dablanc (2005) are that: a) shipments to a city are extremely diverse (from small parcel to full load, from bulk to expensive manufactured goods), b) a delivery implies many more tasks and skills than a simple act of transport (administration, commercial, packaging, etc.), c) urban delivery is just one

¹⁷ According to Foster (2005), it enables British Airways Airport to meet its commitments regarding T5 with an expected reduction in delivery vehicles of 70% and it will provide improved security in the supply chain with pre-booked receipt from known suppliers and X-Ray Scanned deliveries to controlled areas. In-terminal operations will also benefit since there is greater control of airside vehicle movements, minimal delivery equipment left at stores or bays, and reduction in airside/landside security screening for deliveries.

Retailers gain because of the more reliable supply chain, improved staff planning and productivity, improved product availability, increased delivery frequency, drip feed manageable amounts rather than single bulk delivery, added value services, remote stock rooms (either self managed or Exel managed), pre-retailing of goods before delivery and collection of waste cardboard and plastic (processed for recycling by Exel at the Heathrow UTCC).

Suppliers gains since the CC enables a new approach to serving Heathrow, moving from multi drop, manual handling, vehicle size restrictions, airside security, delays at loading bays, delays waiting for store staff to single point of delivery, mechanized receipt, no vehicle restrictions, off airport delivery, delivery window at Heathrow UTCC, immediate off loading and checking.

The environment is also going to gain thanks to the reduction of vehicle movements in and around the airport, improved air quality, reduction of CO2 and effects on wider environment, reduction in NOX and PM10 affecting local environment, reduction in noise pollution, use of alternatively fuelled vehicles (LPG, CNG or Electric) and reduction in congestion levels due to easier access and maneuverability around airport for other users.

part of a global transport chain which has to be mastered at commercial, financial, and technical levels. Tracking from A to Z is an absolute requirement. As a result UTCCs may then be limited to some specific cities: 1) cities wanting to set an example (and ready to pay the price for it), such as La Rochelle's promotion of electric vehicles, 2) touristic cities or cities with a highly sensitive historic centre, 3) cities located apart from the main traffic flows and deprived of private transshipment facilities.

In Italy there are examples of active UTCCs in several Italian cities. Among these the one of Padua is particularly interesting because it is in operation since 2004 and has proven to be financially sustainable and successful in reducing adverse environmental emissions. The main factors determining its success are that it results from an agreement among the main local public authorities and business associations¹⁸, it is hosted in a pre-existing intermodal infrastructure, the majority of transport operators accepted to use the UTCC to deliver their goods in the city center and its low emission vehicles are exempted from time window restrictions and can use reserved bus lanes.

A very relevant issue is which supply chain could take advantage of the services provided by a UTCC. The empirical evidence is scattered. A detailed feasibility study performed for the city of Mestre, Italy (near Venice) evaluating the possibility to adopt a UTCC scheme similar to Padua, concludes that they are likely to be clothing, specialised retails and dry food¹⁹. In the Bristol VIVALDI Project Experience in the UK it is found that the goods using the UTCC were of medium size, non-perishable, and not of high value²⁰ (Hapgood, 2005). In a stated-preference survey study performed in the Italian cities of Fano and Pescara, Marcucci and Danielis (2008) find that clothing and other specialised goods other than food are most likely to accept to use the UTCC, while Ho.Re.Ca is more unlikely to use it.

4. Impact of urban freight policies on distribution channels

In this section we will combine what we have learnt in the previous sections to derive some tentative conclusions about the likely impacts of urban distribution policies on the distribution channels localized within city centres. A summary of the main conclusions is reported in Table 3 where the policies, the main general impact, the relevant factors

¹⁸ The founding members are: Commune of Padua, Chamber of Commerce, Interporto Spa, Province of Pausa, APS Holding Spa- Divisione Mobilità (www.cityporto.it).

¹⁹ Translating from Italian to English, the study of the Comune di Venezia (2008a) concludes that: the largest part of "specialised" food (fruit and vegetable, fish, meet) retailers buy directly using own-account transport from the city markets (*mercati generali*); most Ho.Re.Ca retailers, particularly bars, buy directly from cash&carry shops; high-value product stores (jewellery and watches) would not use a UTCC for safety reasons; pharmacies have their own, fast and efficient distribution channel; tobacco stores are organized in a consortium; larger retail stores are supplied by regional warehouses with their own vehicles; furniture stores have size constraints.

²⁰ Retailers Involved in Bristol are: Lush –Cosmetics; Tie Rack –Men's Fashion; Accessorize –Fashion Accessories; Monsoon –Women's Fashion; Motaman–Car Accessories & Parts; Mastershoe x2 –Footwear ; Past Times –Gifts, household goods; Evolution –Gifts, household goods; Dulay –Men's & Women's Fashion; Kathies Comics –Comics, Magazines ; Paul Richards –Men's Fashion; Art –Art Work, Supplies; Virgin Megastore –Music & Entertainment goods; Virgin Express –Music & Entertainment goods; Carphone Warehouse x4 –Mobile Phones; Vodafone x2 –Mobile Phones

which determine the specific impact and the specific impacts on the distribution channels are summarized.

Access times restrictions, very frequently used in practice, aim at limiting the use of road space to trucks in favour of passenger traffic and the liveability of the city. Since this policy implies a reduction of the time available for delivery, it imposes an additional constraint in the search of a solution to the carriers' routing optimization problem. The impact of access time restrictions on own account carriers is likely to be marginal since they perform a single origin-destination trip (e.g., from the general fruit and vegetables market to their shop) often outside the restricted time windows. On the contrary, third party carriers have to solve a more difficult routing optimization problem, often with multiple origin-destination points, spread all along the working time and on geographically distant shops. Hence, an additional constraint is likely to impose large adjustment costs, generate suboptimal routing, decrease load factors and require larger fleets and a larger number of lorry drivers. Large retail organisation are an intermediate case between own-account and third-party operators. A further element to be taken into account when examining the impact of access times restrictions is the existence of self-implied times windows which depend on the nature of the product or the characteristics of the retail organization. Finally, the distance between shops determines the overall delivery times and costs.

Turning to the impacts on the above identified distribution channels, one observes that pharmaceutical products although distributed by third-party carriers using multi-drop routing are, in practice, exempted from this restriction, hence, they suffer no impact. With regard to fresh food, some products (especially meat and milk) are distributed by third-party carriers using multi-drop routing practices, whereas others (such as non-industrial fish, fruit&vegetables) are procured via own-account transport. If the former can not adjust to the time window regulation by developing an early schedule in non-restricted times because of self-implied time-window constraints, the impact is likely to be relevant. Some segments of Ho.Re.Ca. are impacted when supplied by third-party carriers or wholesalers. Lastly, clothing&footwear will bear only marginal effects since deliveries are less frequent and mostly single-drop. Both Ho.Re.Ca. and clothing&footwear might have self-implied time windows because of staff constraints.

Vehicle restrictions, either by weight, engine type or load factor, aim at containing the environmental and congestion externalities. They cause an increase in fleet size, and an accelerated fleet renewal rate. Larger companies are likely to be able to cope with this policy better than small firms or own-account carriers. The most affected distribution channels are those which require large quantities and frequent deliveries. Pharmaceutical products are delivered frequently but by small vehicles, since the size of the parcels is generally small. Moreover, they are typically exempted from this regulation, hence they are not affected. On the contrary, fresh food, being characterised both by large quantities and frequent deliveries are highly affected, especially when distributed via Large Retail Organization (LRO), because of the weight restrictions, and via own account, because of the engine type restrictions. Ho.Re.Ca. requires less frequent deliveries and small to medium quantities. Hence, it should suffer relatively less the impact of this policy, although procurement takes often place by own-account transport. Clothing&footwear involves unfrequent deliveries, seasonal large quantities and small replenishment deliveries. Hence, it is only marginally impacted. A potential side effect is on the size of the consignments, probably reduced in order to be transported with smaller vehicles.

Table 3: Urban freight policies and distribution channels: general impacts, relevant factors, specific impacts.

Policies	General Impacts	Relevant factors	Expected impacts on distribution channels (DC)
Access-time restrictions	<ul style="list-style-type: none"> - reduction of time available for delivery - more vehicles needed - more lorry drivers needed - suboptimal routing - decreased load factor 	<ul style="list-style-type: none"> - third-party vs. own account - multi-drop vs. single drop - self-implied time windows - delivery frequency - distance from the shops 	<ul style="list-style-type: none"> - no impact on pharmaceutical products DC since exempted - heavy impact on fresh food DC with the exception of fruit and vegetables stores with own-account procurement - impact on some segments of Ho.Re.Ca DC - marginal effects on clothing&footwear DC
Vehicle restrictions (weight, engine type)	<ul style="list-style-type: none"> - fleet size - fleet renewal rate 	<ul style="list-style-type: none"> - third-party vs. own account - carrier size - delivery size 	<ul style="list-style-type: none"> - no impact on pharmaceutical products DC since exempted - heavy impact on fresh food DC when distributed via large retail organizations (weight) or via own-account (engine type) - impact on Ho.Re.Ca DC when supplied via own-account - impact on the drop size of clothing&footwear DC
LU policies	<ul style="list-style-type: none"> - consignment costs and times 	<ul style="list-style-type: none"> - delivery frequency - delivery size - existence of l/u private facilities 	<ul style="list-style-type: none"> - potential impact on pharmaceutical products DC since deliveries are frequent but require short l/u times - high impact on fresh food DC since deliveries are frequent and require medium/long l/u times - small impact on Ho.Re.Ca. DC since deliveries are less frequent with short/medium l/u times - small impact on clothing&footwear DC since deliveries are occasionally large with large l/u times, more frequently small with short l/u times
Fiscal policies	<ul style="list-style-type: none"> - consignment costs and times - multi-dropping routing - loading factors 	<ul style="list-style-type: none"> - consignment frequency - third-party vs. own account - TL vs. LTL - goods value 	<ul style="list-style-type: none"> - no impact on pharmaceutical products DC since exempted - small impact on fresh food DC since they require frequent deliveries - high impact on Ho.Re.Ca. DC and clothing&footwear DC especially for occasional deliveries performed via own-account
UTCC	<ul style="list-style-type: none"> - consignment costs and time - consignment consolidation - use of more environmentally friendly vehicles 	<ul style="list-style-type: none"> - existing regulation - physical characteristics of the good - third-party vs. own account - logistics coordinator 	<ul style="list-style-type: none"> - no impact on pharmaceutical products DC since it is not compatible - no impact on fresh food DC since it is not compatible - potential impact on clothing&footwear DC for occasional orders - potential impact on Ho.Re.Ca DC for non perishable products

Urban goods distribution needs proper spaces for λu activities. Unless a shop has its own private, internal λu bay, it relies on off-street or on-street parking spaces. This generates a conflict with the parking needs for passenger cars, highly requested in central areas. The aim of λu policies is, hence, both to regulate the loading bay use among truck users and to prevent private cars to use the λu bays. λu policies affect substantially consignment costs and times. The actual practise of irregular on-street parking contains the carrier costs and times but generates high congestion costs. The provision of a larger number of λu bays and their effective enforcement would probably leave unchanged or slightly increase the private costs and times, but certainly reduce social costs. Pharmaceutical products are frequently delivered but require short λu times since the parcels are typically small, hence, the impact of a λu regulation is likely to be modest. On the contrary, fresh food is highly impacted since it is frequently delivered, and requires medium\large λu times. Most shops located in city centres do not have internal bays for λu activities, with the exception of large retail organizations that generally have personnel dedicated to stock management activities. Ho.Re.Ca. products are less frequently supplied with medium λu times, hence, the impact of a λu regulation is likely to be small. Clothing&footwear stores are occasionally supplied in large quantities for seasonal orders and require large λu times. More frequently, though, they are supplied in small quantities with short λu times.

Fiscal policies, either in the form of congestion toll or, more frequently, area licensing fees, are used in some cities to regulate access to central areas. They aim to internalize congestion costs and to achieve an optimal congestion level. Fiscal policies should also induce an increase in load factors and multi-drop deliveries. As a result social efficiency of the overall transport system should be achieved. Congestion tolls affect negatively consignment costs, unless the value of the time saved is higher than the fare. This might happen when the value the goods transported is high. Area licensing fees are not proportional to the number of daily access entries, hence, the higher is the daily consignment frequency the lower will be the per-trip cost. The delivery costs of own-account carries are more impacted by fees than those of third-party carries since their load factors are lower. Finally, according to the literature (McKinnon, 2006), the cost of the fiscal policy can be more easily shifted from carriers to retailers when consignments are less-than-truck load.

Examining the impact of fiscal policies on distribution channels, one observes that, again, pharmaceutical products are generally exempted. With reference to fresh food, when a area licensing fee is applied, the impact on fresh food delivery costs is likely to be small since they are characterized by frequent deliveries of large quantities. On the contrary, the impact on the Ho.Re.Ca. and clothing&footwear delivery costs are likely to be relatively higher, since they have less frequent consignments made mostly via own-account. However, the final effect on goods prices paid by final consumers is uncertain, as well as the effect on land rents since they depend on the characteristics of the specific markets. As McKinnon stated (2006), fiscal policies produce most likely small effects, at least in the short run, on strategical and commercial decisions, while they might have some effect on the tactical and operational ones.

The development of a UTCC aims at optimizing the consolidation and routing patterns of the existing distribution channels and at using less polluting vehicles. Since it introduces an extra node in the distribution channel which imposes extra logistics costs, own account or third-party operators or the logistics coordinator of the distribution channel might not be willing to use it. The actual urban goods distribution

regulation may obviously influence the decision favouring the use of UTCC vehicles against all other non- UTCC vehicles (see the case of Vicenza). Given the previous discussion we believe that pharmaceutical products and fresh food will not make use of a UTCC, since the specific characteristics of the goods distributed require dedicated and integrated channels and infrastructures, strong logistics coordination, and fast and frequent deliveries. On the contrary, clothing&footwear and Ho.Re.Ca, especially when supplied via own-account, might accept to use a UTCC: clothing&footwear for occasional replenishment orders, and Ho.Re.Ca for goods other-than-fresh food.

5. Conclusions and further research needs

Several researchers have argued that the impact of the commonly implemented urban distribution policies is likely to be differentiated by type of goods and distribution channels. However, so far, there is no clear understanding of how and why this happens, nor have these impacts been described in detail or measured empirically.

This paper has confronted this issue, firstly, by identifying the main features that characterise a distribution channel. Then, it has selected four type of goods frequently distributed in Italian urban centres: fresh food, Ho.Re.Ca., pharmaceutical products, and clothing&footwear. For each type of good, the main features of their distribution channels have been quantified and described.

Based on the theoretical and empirical literature, five urban distribution policies (goods vehicle access-time and vehicle type restrictions, l/u policies, fiscal policies and the promotion of urban transshipment and consolidation centres) have been reviewed.

Finally, the likely effects of the policies on the distribution channels of the identified five types of goods have been discussed at a speculative level and on the basis of the evidence presented in the literature.

The statement that policies have differentiated impacts by type of goods and distribution channels is confirmed. It is found, in general terms, that the distribution of pharmaceutical products is little impacted by urban freight policies, whereas the other products are more impacted. Specifically, fresh food is mostly affected by access-time restrictions, vehicle restrictions and l/u policies, whereas Ho.Re.Ca and clothing&footwear are mostly affected by fiscal policies and by the promotion of urban transshipment and consolidation centres.

Moreover, the paper has stressed the role played by some crucial features of the distribution channels in determining the final impact. They are listed in the "Relevant factors" column of Table 3. They relate to the good (physical characteristics and monetary value), to the geographical location of the shops (distance between shops), to the institutional arrangement of the transport operations (third-party vs. own-account, and carrier size), to the transport and logistics organization (multi-drop vs. single-drop delivery, delivery frequency and size, TL vs LTL, existence of l/u private facilities, existence of a logistics coordinator), and to the existing regulation.

The above analysis can be useful in two respects: a) in policy modelling since it provides a list of the variables and factors which need to be taken into account in order to forecast or simulate the effect of policy measures, and b) in applied studies since it provides a set of hypothesis which can be further explored and tested with actual data.

The above discussion could also be used in the contest of the evaluation of the private and social benefits and costs of alternative policy measures.

In taking the analysis further, one should be aware that distribution channels evolve continuously: retailers re-localize from the city centres to more suburban areas reacting to consumers and traffic needs; space and transport intensive channels move to peripheral locations; large shopping centres are created outside the urban areas changing the competitive environment; and large retail organizations, characterized by highly efficient supply and distribution channels, substitute small traditional stores. Hence, in order to further explore the impacts of a policy, it is crucial to have a continuously updated map of the urban retailing system, of its distribution channels and of the resulting freight flows. Not enough information is available so far, at least in Italy.

Furthermore, distribution channels comprise many actors (producers, intermediaries, producer organizations, wholesalers, carriers, retailers' organizations, retailers, consumers) who play a very different role within a channel. The role played by each actor and the interaction among them should be better understood. For instance, it would be important to discover if and which actor plays the role of coordinator. Discrete choice models can be of help at this regard (Hensher and Puckett, 2005; Holguín-Veras, 2006, 2007, 2008; Marcucci *et al.*, 2007).

Finally, there is the question of which policy or policies mix should be applied to improve urban distribution channels and the city transport and welfare. To answer this question a detailed, city-specific cost-benefit analysis, encompassing private and social costs and benefits in the short and long run, is needed. On the basis of this paper, there is no single catch-all policy but policies complement each other since they differently affect different distribution channels. In Italy, great hopes and public money are currently put in the promotion of UTCCs. On the basis of our analysis, such hopes are probably in excess of what the policy can actually deliver, whereas less attention is devoted to the potential of the other types of policies.

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