Modelling the carrier’s response to the introduction of new urban freight policies in Brussels-Capital Region

Milena Janjevic a, Alassane Ndiaye b

a Université Libre de Bruxelles, Brussels, Belgium, milena.janjevic@ulb.ac.be
b Université Libre de Bruxelles, Brussels, Belgium, abndiaye@ulb.ac.be

Extended abstract

Objectives and motivation

Urban freight transport in Brussels Capital Region is a key concern of local public authorities and private stakeholders. On private side, recent years have seen the emergence of several sustainable freight operators and several urban consolidation centres servicing the region and run by private companies. Some of these centres have benefited from a limited support of public stakeholders while others are completely self-sustaining. On the public side, the urban freight transport has benefited from a growing concern. The Strategic Plan for Urban Freight Transport in Brussels-Capital Region (Bruxelles Mobilité, 2012) published in 2012 is in fact a first policy document addressing specifically the question of urban freight in Brussels. This document proposes a series of measures to decrease the environmental impact of urban freight transport, addressing the questions of infrastructure, organization, regulation or land-use planning. One of the key measures proposed in this document is the establishment of a logistical pole at a tri-modal site Schaerbeek Formation as well as the establishment of a network of urban consolidation centres (UCCs) servicing the Region. A series of other measures such as distance based freight pricing or off-hour deliveries are being investigated to decrease the vehicles kilometres in the urban area and, indirectly, to promote the use of the logistical zone and the urban freight consolidation centres.

However, regardless the presumed environmental benefits of these measures, little attention has been given to the resulting carrier response. In fact, the setting-up of these new measures lead to a series of questions: (1) what are the current characteristics of deliveries in the region? (2) what is the current cost of delivering in the region? (3) what impact will the introduction of the distance-based freight pricing have on the cost of deliveries? (4) what is the price per delivery that could be charged for UCC services? (5) which portion of carriers will use: the UCC or the off-hour deliveries?

In order to answer these questions, this paper presents a model that was developed to test the carrier response on the aforementioned policies.

General description

This paper presents a model that was developed to test the theoretical carrier response to the new policies in Brussels-Capital Region.

The model uses data on freight flows that was gathered within the LaMiLo (Last Mile Logistics) project using the FRETURB software, a software for diagnosing the urban goods movements. The model was was calibrated with an establishment survey run among 3000 companies in Brussels. The results of this project represented an opportunity to study the carrier’s response in a quantitative manner.

The fist step of the study is the adjustment of the data. In fact, FRETURB software does not allow obtaining information about the origins and destinations of the commodities but rather provides information about the origin and destinations of the freight movements. It is also not possible to obtain information regarding the form of tours (or their direction) made by the specific freight trip. A series of adjustments for the data were therefore necessary in order to make this data suitable for our model.

FRETURB model does however allow a very detailed description of the freight movements. In fact, the model outputs characterizes the freight movements according to: (1) the type of vehicle (light goods vehicles, trucks, trailers and semi-trailers), (2) the management mode (own account shipper, own account receiver, and hired transport), (3) the type or organization (direct trips or tours), (4) the size of the tour (six categories according to the number of points served), (5) the activity sectors (8 different categories), (6) the type of movement (principal or ordinary movement according to the position of the movement within a tour) and (7) the origin and the destination of the movement. The analysis of the data from the FRETURB model allowed providing a very detailed characterization of freight trips in the Brussels-Capital region that will serve as one of the inputs for the carrier-response model. For example, by using characteristics of the flows from the FRETURB model in combination with information about the distance and driving-time gathered through Google Maps API, it was possible to highlight the main characteristics of freight movements for each specific segment (for example, management mode, vehicles and sectors). This has allowed highlighting a series of elements such as average movement distance, average driving time, geographical concentration of origins of the flows, etc. The result was that the main variability was linked to the type of vehicle, the management mode, the type of organization and the size of the tour rather than the sector. For example it was possible to highlight that the hired transport vehicles have systematically better performance in tour organization, servicing more stops by tour and having shorter...
movements and driving times. Similarly, it was possible to see that light goods vehicles have generally more movements per tour than trucks, trailers and semi-trailers but that these movements are shorter. As to the geographical concentration, it was possible to highlight that hired transport and heavy-goods vehicles have origins in the more peripheral areas of the city than own-account transport and light-goods vehicles. Very little variability was seen across the different activity sectors with regards to the characteristics of the movements.

Therefore, the modelling unit used in this paper was defined as: (1) origin/destination pair, (2) type of vehicle, (3) type of management, (4) type of organization and (5) size of the tour. For each unit, a total number of freight trips per week coming from the FRETURB model were considered.

The model also included hypothesis with regards to the cost of transport (per vehicle type and subdivided in three elements: daily cost, kilometric cost and hourly cost), the duration of the stops (per vehicle type, per organisation mode and per size of the tour), the number of parcels and pallets per delivery and the type of packaging according to the type of vehicle.

The model then compared several options: (1) business as usual; (2) distance-based freight pricing; (3) a network of urban consolidation centres; (4) night deliveries. Combinations of these scenarios were considered as well. The model parameters were the cost of distance-based freight pricing according to the type of vehicle, the UCC charge per delivery and the number and location of the UCCs. Based on these parameters, the model assessed the total cost of transportation for each of the options and highlighted the most economically interesting option from a carrier point of view.

Results and conclusions

The application of the model to the freight flows in Brussels has allowed providing a first insight into the possible carrier response to some of the policies that are considered for optimizing the urban freight flows in the region.

This has allowed highlighting a series of interesting elements, such as:
(1) there is an important number of freight trips that are currently performed in the region for which the utilisation of a urban consolidation centre (at market price) is in fact more economical than the current operations - however, a large number of these trips concern own-account transport. In practice, it is difficult to engage these players since in most cases they do not appreciate the real costs of transportation (e.g. the cost of the time they spend themselves in transport);
(2) the utilisation of the UCCs depends mostly on the type of the management (tour or direct trip) and the number of stops per tour and very little on the number or location of the UCCs; the marginal effect of adding additional UCCs for servicing the region decreases with the number of the UCCs and the cannibalization effects between the additional UCCs and the main logistical zone at Schaerbeek Formation can be observed;
(3) the distance-based freight charging has less effect than expected on the usage of the UCCs since the hourly cost of operations is the principal cost item;
(4) the night deliveries have the advantage of reducing the main cost item which is the hourly cost of operations and can be interesting in a series of options.

In conclusion, this paper highlights the potential carrier response to a series of measures and shows that there are several policies that can be beneficial from the carrier point-of-view. However, as highlighted by Holguin-Veras and Aros-Vera (2014), receivers are often those that dictate the terms of deliveries. In order to complete the analysis, an insight into a receiver response is therefore necessary. Finally, in order to motivate receivers, self-supporting freight demand management schemes as ones proposed by Holguin-Veras and Aros-Vera (2014) should be considered more closely.

References


Keywords: urban freight transport, urban consolidation centres, distance-base freight pricing, carriers