

Receivers’ willingness-to-adopt novel urban goods distribution practices

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Extended abstract

Objectives and motivation

There is no doubt that goods transport continues to play a vital role in today’s society, in spite of the advances made with new information and communications technologies. The last mile, required to deliver the goods to the receivers, will continue to be an important part of urban dynamics because the distribution vehicles have to circulate on the road network. This proliferation of commercial vehicles in urban centers, sometimes operating under size and weight restrictions, causes a considerable increase in the overall number of circulating vehicles. This results in major world cities being characterized by high levels of congestion on their streets which is normally accompanied by high levels of atmospheric and noise pollution. The policy-makers responsible for urban goods distribution must therefore find solutions which allow the smooth flow of goods to their destinations without prejudicing the functioning of the rest of the city. This can only be done by taking into account the opinions of the stakeholders implicated in urban logistics when defining the policies, as they are the main actors in the last mile, and without their agreement it would be impossible to successfully adopt any urban distribution policy.

The main objective of this research is to analyze the behavior of goods receivers in two Spanish cities when they are confronted with the possibility of adopting new goods distribution policies. The analysis has addressed a subject which has received little attention in the scientific literature; most research has concentrated on analyzing practical cases or the economic or social implications of new policies without considering their acceptance levels among the agents involved in the last mile. The new goods distribution policies proposed to the receivers were: an Off-Hour Deliveries policy (OHD), where goods distribution is made during the night time, both staffed deliveries (with the presence of the retailers in their premises to receive the goods) and unassisted deliveries (the carriers deliver the goods in an external or internal warehouse without requiring the presence of the retailers); and a policy which use Urban Distribution Centers (UDC), where the goods are sent during the night time and the last mile is delivered during normal commercial hours using smaller environmentally friendly vehicles.

General description

The methodology used is based on discrete choice models and more specifically in a mixed logit model (Train, 2009). This model has a hedonic formulation with random parameters which represent the variations in tastes across individuals. The distribution function chosen for the parameters depends on the variables themselves and should be the most appropriate to adequately reflect the real distribution of the values of the parameters in the population.

The model takes the following formulation (Ortúzar and Willumsen, 2011):

\[ P_q(\tau^*) = \int S_q(\theta) f(\theta|\tau^*) d\theta \]  \hspace{1cm} (1)

where \( S_q(\theta) \) is the probability of the MNL model, \( f(\theta|\tau^*) \) is the density function of the parameters and \( \tau^* \) represents the mean and the standard deviation of the population’s tastes.

The information required to calibrate the model is obtained from a stated preferences survey asked to various goods receivers from different commercial sectors. Given that the input data for the model come from this kind of survey, each receiver can only choose one of the policies being analyzed in each of the proposed scenarios. The study has considered six different commercial sectors which cover all kinds of commercial activity in the cities: hospitality, food, textiles, furniture, press and books, and non-specialized retailers.

Eight possible scenarios are proposed for each city. In Santander the first scenario (S1) proposes the OHD delivery method without any tax reduction for the receivers, while the second scenario (S2) offers a 5% tax reduction. The third scenario (S3) offers an incentive only to the receivers from specific sectors. Finally, the fourth scenario (S4) is similar to S3, but the delivery method is carried out in the presence of the receiver between 22.00 and 24.00. The scenarios using UDC policy were: the first two scenarios (S5 and S6) do not propose any tax reductions for the receivers and guarantee delivery during the morning for the hostelry sector (the rest are not affected
by the schedule); however, in scenario S5 the distance between the UDC and the receiver is greater than 500 meters, while in scenario S6 the UDC can be located at less than 500 meters from 30% of the receivers (except for the textile sector and the furniture sector who prefer to have them further away). Scenarios S7 and S8 are similar to the previous two, but in this occasion a 5% tax reduction is also offered to the receivers who adopt the plan.

In Barcelona the OHD policy only focuses on certain sectors because there is not an overall general effect for all the commercial sectors. Therefore, scenario B1 concentrates exclusively on the hostelry sector, the food sector and the furniture sector, where the carrier delivers the goods directly to an external warehouse and without offering any tax incentives. Scenario B2 adds delivery to the press and books sector between 4.00 and 6.00 in the presence of the receiver to the previous scenario. Scenarios B3 and B4 are similar to the previous scenarios, except they also offer a 5% tax reduction to the receivers in the food sector and the hostelry sector. In UDC policy scenario B5 does not offer the receivers any tax reductions or reductions in stock levels held on their premises, the distance between the UDC and the receivers’ premises is over 500 meters and delivery is guaranteed during the morning. Scenario B6 is similar with the addition of offering the textile sector and the press and books sector receivers their own space at the UDC which allows them to reduce the stock they hold on their own premises by 30%. Scenario B7 differs from B5 in that it is now possible to locate the UDC at less than 500 meters from 10% of the receivers (except for the furniture sector and the press and books sector who prefer to have it further away). Finally, scenario B8 is similar to B5 but also offers the receivers a 5% reduction in the tax they have to pay.

Results and conclusions

The results for each scenario were obtained from the models estimated (see Table 1).

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Santander Receivers accepting the policy</th>
<th>Barcelona Receivers accepting the policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>6.46%</td>
<td>4.64%</td>
</tr>
<tr>
<td>S2</td>
<td>10.08%</td>
<td>5.91%</td>
</tr>
<tr>
<td>S3</td>
<td>6.76%</td>
<td>5.72%</td>
</tr>
<tr>
<td>S4</td>
<td>11.80%</td>
<td>6.99%</td>
</tr>
<tr>
<td>S5</td>
<td>19.60%</td>
<td>23.91%</td>
</tr>
<tr>
<td>S6</td>
<td>19.63%</td>
<td>24.15%</td>
</tr>
<tr>
<td>S7</td>
<td>20.30%</td>
<td>23.98%</td>
</tr>
<tr>
<td>S8</td>
<td>20.51%</td>
<td>24.06%</td>
</tr>
</tbody>
</table>

Table 1. Percentage of receivers who accept the analyzed policies in each of the proposed scenarios

Generally, receivers do not wish to change the manner in which they receive their goods, especially if such change involves increased costs (either in terms of time or money). Nevertheless, ways of encouraging receivers to accept changes have been presented which will result in fewer distribution vehicles circulating at peak times on urban streets.

A minimal use of resources (without the need to provide fiscal incentives and with minimal investment in warehouses and UDC) has been shown to go a long way in encouraging receivers to accept the OHD and UDC policies. For example, for the OHD policy, 6.5% of the receivers in Santander and 4.6% in Barcelona can be convinced to use the policies with a small investment fitting out warehouses where the carriers can deliver the goods during the night. Similarly, the UDC policy is feasible for 19.6% of the receivers in Santander and 23.9% from Barcelona who would use it, even when the UDC is located over 500 meters from their premises, if they receive a guaranteed delivery time slot (in the morning for most of the commercial sectors). In some cases it is recommended that some incentives are used to encourage receivers to participate in the policies.

References


Keywords: Urban freight; Stated Preferences; Discrete Choice Models.