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

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ABSTRACT

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 main objective of this research is to analyse the behaviour of goods receivers in two Spanish cities (Santander and Barcelona) when they are confronted with the possibility of adopting new goods distribution practices. The new goods distribution policies proposed to the receivers were: an Off-Hour Deliveries policy (OHD) and a policy which uses Urban Distribution Centres (UDC). The methodology used was based on a stated preference survey and a Mixed Logit model. The results show that in both cases, receivers generally do not wish to change the manner in which they receive their goods, especially if such change involves increased costs. However, both policies were generally more accepted in a medium size city like Santander than in Barcelona, and some results can be achieved even without tax reductions which will result in fewer distribution vehicles circulating at peak times and therefore less congestion and pollution on urban streets. In addition, it is important to consider that not all the commercial sectors react the same way, so this heterogeneity has to be taken into account in the specification of the models and in the proposed policies.

1. Motivation and objectives

Goods transport continues to play an important role in today's society, in spite of the advances made with new Information and Communications Technologies (ICT). Clearly, it is vital for modern society to have the required products available at the correct place and time. New ICT are changing both, the distribution systems and the technology used, and can even modify urban goods dynamics by eliminating some of the intermediaries: the retailers themselves. Nevertheless, as the goods still have to reach the final consumer, the distribution systems are an important factor which needs to be efficient within the overall process. This efficiency is particularly important because of its influence on traffic flows, especially in the most congested areas.

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 centres, sometimes operating under size and weight restrictions, causes a considerable increase in the overall number of circulating vehicles. These distribution vehicles are normally larger, slower and more polluting than the other vehicles they

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share the road with. 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 (Russo and Comi, 2011a). 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. It is also important to particularly focus on the receivers, given that they are the main decision-making agents when introducing a policy and tend to play the dominant role in urban freight distribution (Holguín-Veras et al., 2007b).

The research presented in this paper concentrates on understanding the mechanism that leads to goods receivers accepting new urban goods distribution policies. This knowledge will allow us to identify the potential of each commercial sector when proposing different policies which are tailored more to their particular needs. To this end a stated preferences survey to the retailers of two very different Spanish cities, a medium sized town with moderate congestion (Santander) and a large city with high traffic congestion (Barcelona), was undertaken about their willingness to use two new distribution practices: an Off-Hour Delivery (OHD) and a collaborative system consisting of urban distribution centres (UDC). From this information along with a Mixed Logit model (ML) (Train, 2009) with repeated observations and taste variation among different commercial sectors, it is possible to determine which variables have most influence on the goods receivers when choosing a certain urban distribution policy, as well as forecasting how many of them would adopt each of the proposed policies. This method provides the decision-makers with the necessary tool to select an effective urban distribution policy and at the same time address the main aim of the process which is to reduce environmental spillovers and traffic congestion.

The paper is divided into six sections. After the introduction, Section 2 provides the required background on receiver behaviour and the policies being analysed. Section 3 describes the methodology followed in developing the research. The estimated models are presented in Section 4 for two study areas: Santander and Barcelona. Section 5 analyses the behaviour of the receivers in different proposed scenarios, followed by a discussion and comparison of the results. Finally, in Section 6 the conclusions are presented.

2. State of the art

For several decades different initiatives have had greater or lesser degrees of success at alleviating the adverse effects caused by urban goods distribution. Some of the more relevant policies are those which promote the use of collaborative transport systems and those directed at reducing the number of distribution vehicles circulating at peak times.

The collaborative initiatives have twofold objectives: firstly, to reduce the number of journeys required transporting the goods to their destinations and, secondly, to increase the loading factor of the distribution vehicles, which are not normally higher than 30–40% (Taniguchi and Thompson, 2003). Collaborative systems aim to reach these objectives by setting up, as the name implies, collaborations between different companies so that their goods can be delivered together. In spite of the practical difficulties inherent in such systems caused by conflicting interests in economic matters and other issues such as determining responsibility in case of problems, it has been shown that operating costs can be reduced by 12% and that vehicle parking time and round trip time can be reduced by 50% and 90% respectively (Wood, 1970).

One of the first collaborative systems used was the Joint Delivery Service (JDS), where a group of carriers form a neutral company, independent from those operating in the city, which is contracted to deliver the last mile. Research aimed at evaluating the efficiency of JDS (Kawamura and Lu, 2007) has shown that these only turn out to be profitable with high traffic densities and if the companies find themselves forced to use smaller vehicles. Under other circumstances carriers will only use collaborative systems if they receive incentives, either rewards for using the system or disincentives for not using it.

A variant of the system mentioned above is the Joint Staging Area (JSA), where a resting area is set aside for drivers arriving from outside the city (Holguín-Veras et al., 2007a). This system allows the carriers to complete their long-distance routes during the night and then, after resting, they themselves (or other drivers in smaller vehicles) are able to deliver the last mile. This system manages to reduce daytime congestion in urban areas.

One of the more successful collaborative systems has been shown to be the Multi-Carrier Joint Delivery Service (MCJDS), put into practice in Fukuoka, Japan (Ieda et al., 2001). This system holds the goods that have arrived from outside the city at a freight consolidation center from where, once they have been consolidated, a series of carriers provide the final urban delivery service. Several German and Swiss cities (for example, Fribourg and Nuremberg) have also successfully introduced similar cooperative systems (Kohler, 2001). Nevertheless, some of these have been tried in smaller cities where congestion is a relatively minor problem and this has meant that participating carriers have not been motivated enough to continue using the system, as their main incentive is to avoid urban congestion.

Policies aimed at reducing goods distribution at peak hours, however, were mainly introduced to reduce the percentage of heavy vehicles circulating at peak traffic periods. Of all these policies, the most widely used has without doubt been the night distribution of goods or Off-Hour Delivery policy. There are examples where success has been achieved in spite of the opposition of most of the goods receivers who were unwilling to remain present at their premises during the night to receive their goods when previously they had done so during commercial opening hours. In Manhattan, the borough with the highest population in New York, a pilot test was run to persuade some of the carriers to make their deliveries during the night. After overcoming initial difficulties in trying to convince the retailers (not a trivial matter), it has been possible to reduce travel

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