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A methodology to evaluate the prospects for the introduction of a Park&Buy service

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Abstract

The paper analyses the potential for introducing a Park&Buy service in the city of Pesaro (Italy) along the lines of the pilot project introduced in Siena, Italy, in 2004. It attempts to empirically evaluate the preferences of the parties involved and derives some suggestions on the potential compromise solution via a specifically designed stated preference experiment, drawing from the literature on interactive agency discrete choice modelling. Although various theoretical and methodological issues are still open for discussion, the methodology proves useful in giving insights not only on the parties' preference structure - as normally achieved by discrete choice models - but also on shopkeepers perception of customers' preferences, on the room for bargaining, on each party's influence on choice attributes and on the determinants of the probability of achieving a comprise solution.

Keywords: City logistics; Interactive choice experiments; Discrete choice.

1. Introduction

City centers, especially historic ones, suffer from lack of space to accommodate traffic and parking of private cars. City administrators often restrict motor vehicle access to city centers in order to preserve their aesthetic quality and to reduce congestion and pollution. While these policies support some activities (leisure activities, tourism, etc.), shopkeepers situated within the city center often oppose to traffic restrictions on the grounds that they favor shops and malls equipped with large parking facilities located outside the city boundaries.

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Policies aimed at reducing private car traffic are often accompanied by those limiting or regulating freight vehicle access to city centers. In Europe this set of policies is defined by the concept of city logistics, since its objective is to optimize goods distribution in an urban area.

Various city logistics proposals have been advanced (see e.g. Bestuf, Cityports, CityFreights projects, LT Consultants and BCI, 2002; Egger and Ruesch, 2004; Panebianco and Zanarini, 2005) and a number of pilot projects have been implemented. An interesting one is the Park&Buy (P&B) service implemented in Siena for two weeks in 2004 within the eDRUL project (funded by the 5th Framework Programme)[1]. It aims at improving the accessibility to visitors and tourists to the 750 shops located within the city centre. Due to access restriction, in fact, visitors and tourist, contrarily to residents, can only park their vehicles in the parking lots located outside the city centre. The *P&B* service allows the customers of these shops to have their purchases delivered to the parking facilities or to their hotels.

During the two-week test the parcels of 10 shops located in the centre of Siena were delivered by a transport operator[2] to the parking lot "Il Campo"[3]. The *P&B* service order was processed by the shopkeeper and was forwarded to the e-DRUL Agency (via a web portal or by phone) which notified it to the transport operator and to the customer. When the parcel was delivered to the pick-up point the consumer was informed via as SMS.

The *P&B* service tested in Siena showed two important advantages (Ambrosino *et al.*, 2005a): (a) the efficient management of the freight traffic from the city centre to areas outside the restricted zone; (b) the increased attractiveness of the shops located in the Traffic Limited Zone (TLZ) and, in particular, of those located farther away from the parking lots.

The *P&B* system is similar to other home delivery services provided in France by shops and supermarkets associated to the Nanterre PAD, in Belgium by the Delhaize supermarkest, in UK by TESCO, in Switzerland by the online supermarket LeShop (Egger and Ruesch, 2004), or by other pick-up point organizations such as Tower24 in Dortmund, DHL PackStation in Koln, Cityssimo and E-Box in Paris[4]. This city logistics innovation seems particularly suitable for Italian and European cities centers characterized by TLZs, good public transport accessibility and high commercial attractiveness. Moreover, it is in line with BESTUFS recommendations (Huschebeck and Allen, 2006) stressing the attractiveness of pick-up point services compared to traditional home delivery services and underlining the importance of information and communication technology (ICT).

However *P&B* raises some economic and distributive issues too. For instance, who should pay for the service? Shopkeepers, customers, or both? In which proportion[5]? How quickly should the parcels be deliveded at the parking lot? How frequent should the service be? Should the parcels be delivered on request to other destinations (e.g. home delivery)? And who should pay for that extra-service? Should the service be organized using information technology or not?

[1] See the website http://srvweb01.softeco.it/edrul/
[2] CO.TA.S. (Consorzio Tassisti Senesi, www.cotas.it)
[3] operated by SienaParcheggi as a business-to-customer (B2C) freight pick-up point
[4] For more information see Egger and Ruesch, 2004or visit www.bestufs.net
[5] In Siena the *P&B* service cost was estimated to be between 3 to 5 € per parcel (including transport and order management cost) but the shopkeepers were willing to pay only 2 € per parcel.

We believe that it would be useful to answer to these questions and to predict if and under which conditions the *P&B* system could be successfully implemented in Italy. It seems to us, indeed, that the technological feasibility of the service is less critical than the lack of willingness of shopkeepers, customers and the city administrators to participate to the project and to share its costs and risks.

Shopkeepers, first and foremost, are the ones who should be actively involved in organizing the service. However, in a city center, there are numerous types of shops (groceries, domestic appliance shops, clothing departments, jewelry stores, bookstores, furniture stores, etc.) and it is quite likely that they would benefit differently from the new service. It is to be expected, then, that they would be differently willing to participate to the project. It sould be noted that the Siena pilot experiment was funded by the City Council and the European Union, but that, in order to be financially sustainable, should be fully supported and properly financed by the local business community.

Customers, who are likely to benefit from the new service, need to actually use it and, at least partially, to pay for it. However, similarly to shopkeepers, different customers will differently benefit from its implementation and, hence, their interest and willingness to pay for it is likely to differ. Whether and how much customers are willing to be involved in the project is a matter which needs to be evaluated empirically.

Finally, city administrators should encourage, promote and guarantee the conditions needed for the service to be successful, including the initial financing of the project and the setup of the regulatory framework within which the new service will take place. The city will benefit from the P&B service as long as the related traffic restraint policies will be accepted and the attractiveness of the city center will be enhanced. Indeed, a successful historical center is likely to raise real estate values and provide higher local tax revenue.

Because there are many different actors which would be involved in the new service and because they have quite different interests, formal and informal bargaining is likely to take place among them. The interacting feature of the bargaining process, although, is quite difficult to be analyzed at the theoretical, methodological and statistical level.

Since the aim of our research is to forecast agents' future demand for *P&B* service and to account for the bargaining process taking place among the main actors deciding if and how to implement it, we based our research on an interactive discrete-choice modelling framework originally conceived by D. Hensher and his associates at ITSL, University of Sidney (Hensher *et al.*, 2007a).

The first part of the paper (Section 2 and 3) is focused on the theoretical and methodological issues involved in the analysis of interactive decision making processes, while the second part (Sections 3 and 4) describes our case study and the descriptive and the econometric results we have obtained, finally Section 5 provides some conclusions and lists our future research lines on this topic.

2. Theoretical and methodological issues in the study of social interaction

Interaction between agents takes place in many ways. At one end of the spectrum, agents interact in decision making as members of an institution (e.g., a family or a firm). They are bound by sentimental or contractual relationships and take some decisions

jointly, after formal or informal group discussion. These decisions can be classified as group decisions and can be modelled as group choices. An incomplete list of papers on *group choice modelling* includes Molin *et al.* (1997), Arora and Allenby (1999), Aribarg *et al.* (2002), Gliebe and Koppelman (2002, 2005), Zhang *et al.* (2005, 2006a, 2006b), Dosman and Adamowicz (2006), Puckett and Hensher (2006).

On the other end of the spectrum, there are individual decisions (e.g., individual consumption decisions) which, although taken without consulting other agents, entail an element of social interaction, since they are taken in a social environment (involving, e.g., imitation, image setting, peers' opinions). Relevan literature on *individual choice modelling with social interactions* includes Durlauf (2001), Brock and Durlauf (2001, 2003), Kooreman and Soetevent (2002), Hartmann and Yildiz (2007), Kooreman (1994), Brewer and Hensher (2000) and Paglione (2007).

Most business decisions, indeed, take into account other agents' preferences. Sometimes this is only implicit (e.g. in setting the price for a product a shopkeeper takes into account his clients' preferences), in other cases there is an actual bargaining process taking place via an explicit interaction among the buyer and the seller. During the bargaining process each agent might decide to either cooperate, that is "to play the game" or not to do so, that is "to exit the game".

An agent has an interest in playing the game only if s\he perceives that finding an agreement generates an improvement in her\his welfare compared with the no agreement situation. Each agent might propose a deal to split the gain, while the other agent might accept it, make a counter-proposal or exit the game. Entering a game and leaving it without reaching an agreement might entail a monetary or an opportunity cost.

We assume that a similar relationship exists between the shopkeeper and his customers when the *P&B* service is considered[6]. Such a relationship could be conceptualized as an interaction between two parties which takes the following steps. The shopkeeper designs the service in order to please customers and attract more business. The service will have certain technical characteristics (in terms of frequency of delivery at the parking lot, use of information technology and so on) and certain costs that need to be financed by the two parties[7]. The shopkeeper will propose a certain cost distribution to the customers. The customers might accept the proposal and use the new service or might refuse it.

Taking into account this interaction process is important to enhance the realism of any model describing the potential demand for a new logistic service involving more than one actor, indeed our aim is to develop an operational model that can describe the bargaining area of the agents potentially involved in the *P&B* system, that is shopkeepers and customers, that can estimate the values at stake and that can predict which service set up would be most probably accepted by those actors.

Since the decisions taken by shopkeepers and by their customers determine the success or failure of the *P&B* service, it is useful to analyse how their preferences might interact in determining the acceptability and the success of this service. In this respect a promising research framework is the inter-agency choice modelling, otherwise stated group decision modelling. Within this literature a common representation of the

[6] In the remaining of the paper we abstract, for the sake of simplicity, from the role played by the city administration and from interactions taking place among shopkeepers in deciding how to set up and finance the service.

[7] There is also a potential contribution from public subsidies motivated by improved attractiveness of the city centre and local taxed revenues.

interaction process involving two parties is described by the following equation [Arora and Allenby, 1999; Aribarg *et al.*, 2002; Dosman and Adamowicz, 2006; Zhang, *et al.* 2005, 2006a, 2006b]:

$$U_d^j = \tau_{sk}\beta_{sk}X_k^j + (1-\tau_{sk})\beta_{ck}X_k^j + \varepsilon^j \quad (1)$$

Equation (1) describes the utility that a hypothetical dyad *d*, made up by two agents (the shopkeeper *s* and the customer *c*), derives from choosing an alternative *j* (where *j = 1…J*) as a weighted sum of the utilities of each agent, with the weights represented by the parameters τ and (1 - τ). Notice that even if both agents choose the same alternative *j*, each of them experience different marginal (dis)utilities[8] associated with it, given the fact that each of them has different preferences, represented by the agent-specific β's. The parameters τ and (1 - τ) are the weights that multiply the agents' marginal utilities and represent the relative influence that each agent exerts in the final group choice.

The additive formulation of the systematic component of the utility function of the two agents equation (1) assume cardinal and interpersonally comparable utility functions as theoretically advocated by Harsanyi (1955). This is a crucial assumption discussed at length in public choice literature (see, e.g., Mueller, 1989), with little support in normative economics but, in our opinion, it is still a useful modeling tool given the positive approach adopted in this paper.

Notice also that equation (1) includes the specific assumptions made in most studies (Arora and Allenby, 1999; Aribarg, et al., 2002; Puckett and Hensher, 2006) that each agent has an *attribute-specific influence*, implying that there are as many τ parameter as the number of attributes included in the model.

Drawing from the modelling frameworks proposed David Hensher and his associates at ITSL (Sidney) like the Interactive Agency Choice Experiment (IACE, see Brewer and Hensher, 2000Rose and Hensher, 2004), the Minimum Information Group Inference (MIGI, see Hensher andPuckett , 2006), and the Stated Endogenous Attribute Level (SEAL(Puckett *et al.*2007) we developed a methodology comprising the following 4 steps.

First, a selection of relevant attributes for the *P&B* service is identified by the research group on the bases of literature review and of focus groups discussions involving shopkeepers. These attributes are used to design the *P&B* alternatives to be administered to the shopkeepers and to their customers during a stated preference choice exercise.

Second, during the interview each shopkeeper is asked to make two proposals on the cost distribution and technical characteristics of the service (Table 1): a) the one s\he prefers the most and b) the one s\he deems most preferred by his\her customers. Alternatively, the shopkeeper may decide not to make any proposal if s\he deems it not worth for his\her business. This second step provides us with information on the shopkeeper's preferred alternative and on his\her perception of his\her customers' preferred alternative. It also produces a customization of the choice experiment

[8] The possibility that the β's attached to each attribute represents a marginal utility or disutility depends on the nature of the attributes considered (goods or bads).

similarly to the SEAL methodology[9], whereas in the IACE methodology attribute levels are set and fixed by the analyst.

Table 1: An example of choice tasks submitted during the stated preference exercise.

Under your point of view a Park-and-Buy service (delivering parcels to the parking lot) would make sense for your business? If, yes, which characteristics should it have?			
Attributes	Alternative A*	Alternative B*	None of the two is convenient to me
Cost per parcel to be charged to the shopkeeper	€ 2	€ 3.6	-
Cost per parcel to be charged to the customer	€ 2.2	€ 0.8	-
Maximum delivery time at the parking lot	90'	150'	-
Use of information technology	Yes	No	-
Destinations other than the parking lot	Not available	Available, charging the extra cost to the customer	-
Preferred alternative by the shopkeeper **	-	-	-
Preferred alternative by the customer with no knowledge on shopkeeper's preference§	-	-	-
Would the client accept the alternative chosen by the shopkeeper? **	-	-	-

Notes: * During the second step A stays for: "This is in my view the optimal solution for my business" and B stays for: "This is, in my view, the optimal solution taking the point of view of my customers". During the third step A stays for: "Alternative A" and B stays for: "Alternative B".
** This part of the task is used only during the third stap of the interview.

The third step consists in designing and administering to the shopkeeper 13 choice tasks including two hypothetical profiles that are pivoted orthogonal variations of the *P&B* alternative chosen by the shopkeeper himself during the previous step and the non-choice option.

As a forth step the choice experiment used for the shopkeeper interview is administered to his\her customers. They are asked to choose among the alternatives in the same 13 choice tasks proposed to the shopkeeper without knowing the shopkeeper's choice. Then the shopkeeper's choice is revealed to the customers and they are asked whether they would accept or not the shopkeeper's choice.

This methodology can be thought as an application of an Ultimatum Bargain Game where one player makes a proposal on how to share the surplus of a cooperative interaction with the other player, or in our case how to set up the *P&B* service, while the other player can only accept the proposal or refuse it, ending in this way the game with no gains for both agents.

[9] With no revision of the starting preference on the basis of a second agent counter-proposal as performed within the SEAL methodology.

A further possibility, although we have not implemented it yet, would have been to go back to the shopkeeper, show his\her customers' choices and ask him\her to reconsider his\her choices.

The data collected during the third and fourth step from the shopkeepers and from their customers can be analysed via a nested logit model (Figure 1) where each agent can choose either to participate to the service or not to do so. In the former case the agent can chose between two *P&B* alternatives.

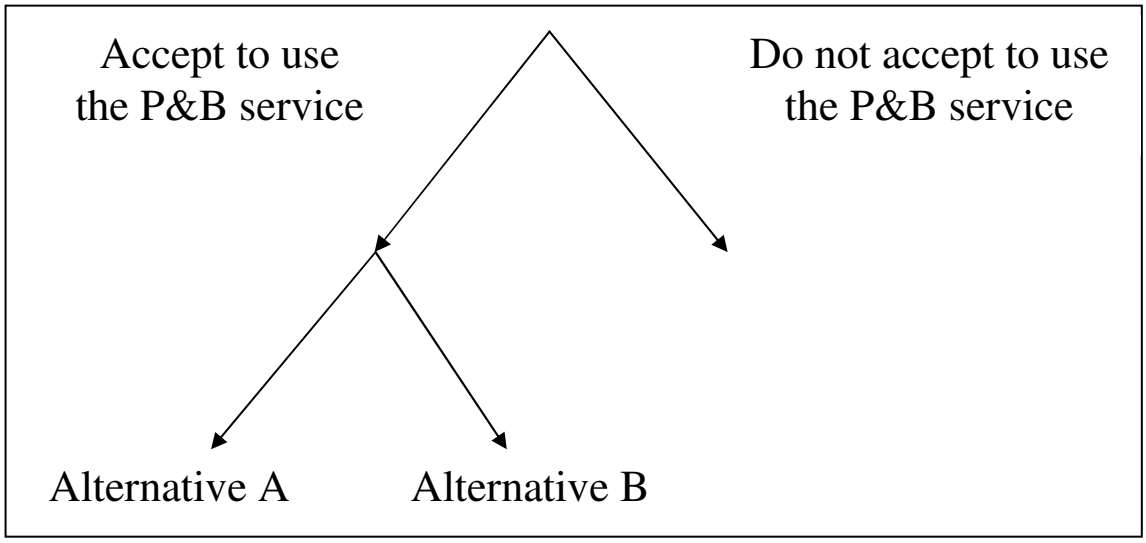

Figure 1: The nested structure of the choice model.

Since there is no actual joint choice, in order to study what the shopkeeper-customer group choice would be we use the initial pass power model developed in the MIGI methodology by Hensher and Puckett (2006). The estimated coefficients of the choice model of each party are used as constant exogenous terms specifying the *initial pass power model*, and are multiplied by the corresponding attribute levels of the *K* attributes of each hypothetical *j* alternative. For each simulated group interaction, the alternative designated as the choice is the combination of the stated choices of the two parties.

In a three-choice set up the model looks as follows:

$$
\begin{aligned}
U_{11} &= \alpha_{11} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{1k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{1k} + \varepsilon_{11} \\
U_{12} &= \alpha_{12} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{1k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{2k} + \varepsilon_{12} \\
U_{13} &= \alpha_{13} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{1k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{3k} + \varepsilon_{13} \\
U_{21} &= \alpha_{21} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{2k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{1k} + \varepsilon_{21} \\
U_{22} &= \alpha_{22} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{2k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{2k} + \varepsilon_{22} \\
U_{23} &= \alpha_{23} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{2k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{3k} + \varepsilon_{23} \\
U_{31} &= \alpha_{31} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{3k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{1k} + \varepsilon_{31} \\
U_{32} &= \alpha_{32} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{3k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{2k} + \varepsilon_{32} \\
U_{33} &= \alpha_{33} + \left(\tau_{sk} \cdot \beta_{sk}\right)' \cdot x_{3k} + \left(\left(1-\tau_{sk}\right)\cdot \beta_{ck}\right)' \cdot x_{3k} + \varepsilon_{33}
\end{aligned}
\qquad (2)
$$

This is the complete power model. When restricting the model to agreement cases, the model reduces to the subset of equations in which alternative *j* is identical for both agents (i.e., both choose 1, both choose 2, or both choose 3). Hensher claims that the focus of group decision making modeling should be on both studying (i) the full set of group preferences; and (ii) the agreement outcomes only. The former specification is particularly useful in investigating potential barriers to agreement (as shown in Brewer and Hensher 2000).

As a generalization of model (1) Zhang *et al.* (2005) proposed a specification of the group utility function termed the *multi-linear group utility function:*

$$U_g = \sum_{i=1}^{n} w_i u_i + \sum_{i_1=1}^{n} \sum_{i_2>i_1}^{n} \left(w_{i_1 i_2} u_{i_1} u_{i_2} \right) + ...w_{i:n} u_1 u_2 ... u_n \quad (3)$$

Where w_i is member i's weight parameter, and $w_{i_1 i_2}$,…… $w_{1\text{-}n}$ are the intra-household interaction parameters. This model assumes that household utility can be derived by weighting the utilities of the individual household members, and adding interaction effects. The weight w_i can be interpreted as a measure of a member's power or influence over the group decision-making. The interaction parameters $w_{i_1 i_2}$,…… $w_{1\text{-}n}$ moderate the power effect and reflect the group members' concern for achieving equality of utilities. The larger the interaction parameter, the higher the group's collective desire to choose an allocation such that the utilities of all household members tend to be equal. We test if the specification (3) of the utility function of the group is superior to specification (1).

3. Sample description and descriptive results

The city of Pesaro (together with the city of Urbino) is one of the main towns of Marche region, which is located in the centre of Italy. We interviewed 21 shops located in the city centre of Pesaro, specifically: 5 shops selling clothing, 8 groceries, 1 bookshop, 1 footware, 1 optician, 3 shops selling home furnishing, 1 textiles and 1 underwear. The sample used for the econometric analysis reduced to 19 shops due to the fact that 2 of the shopkeepers (the optician and the one selling underwear) stated that they were not interested in the implementation of the *P&B* service.

The analysis of the information stated by the shopkeepers during the second step of the research (which are described in figure 2) shows that they are willing, on average, to accept a cost equal to 0.68 Euro per consignment. 7 of them do not accept any charge, while 2 shopkeepers would accept a 2 Euro charge.

On average shopkeepers propose to charge their customers 1.39 Euro per consignment, ranging from a minimum of 0.5 Euro to a maximum of 3 Euros.

All but one shopkeeper would prefer to use information technology (either computer based or portable cellular phones) to process and monitor the service. 7 of them do not consider desirable to extend the service destination beyond the parking area, while 12 think that home delivery is a desirable feature but that their customers should be charged for the extra-service.

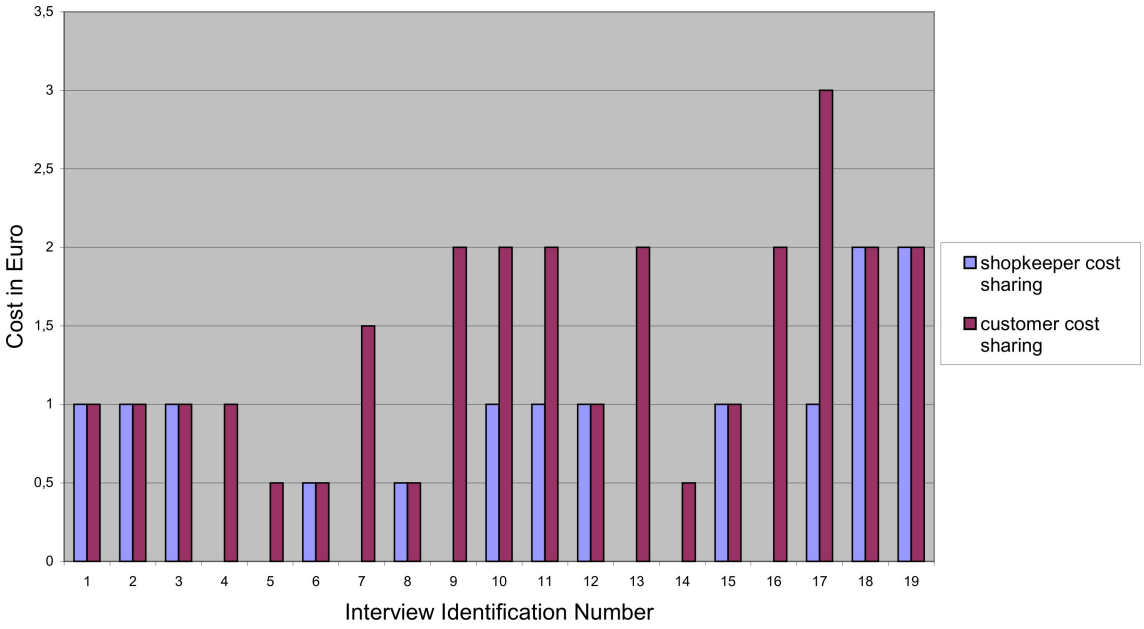

Figure 2: P&B cost sharing according to shopkeepers.

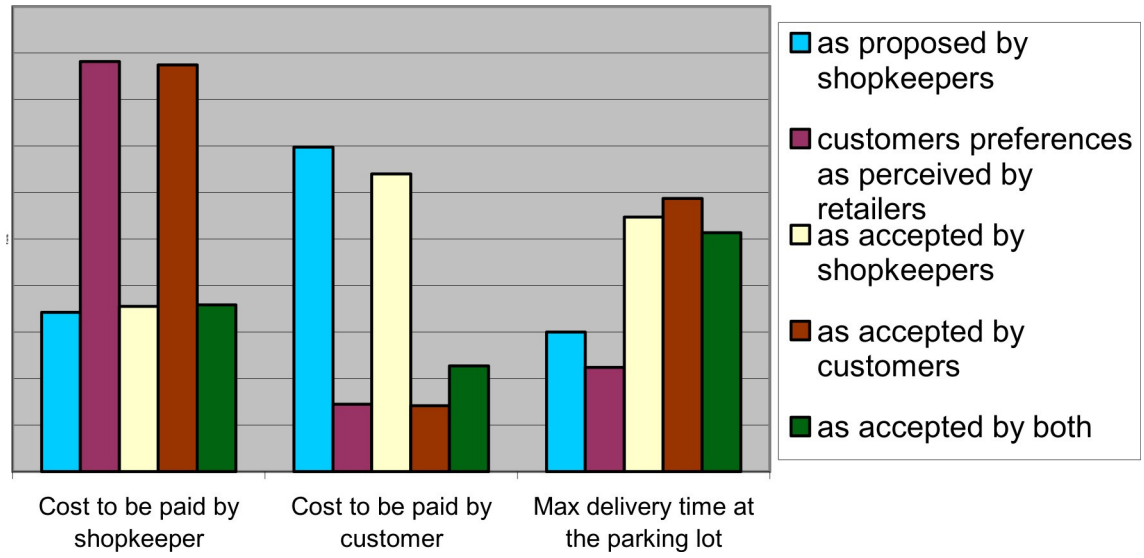

Figure 3: P&B cost sharing and frequency.

The bargaining process between shopkeepers and customers relatively to the *P&B* cost sharing and the maximum delivery time at the parking lot is depicted in Figure 3 showing that:

a) Costs to be borne by shopkeepers. On average, in the first task, shopkeepers stated that they would accept to pay 68 Eurocents per parcel as a contribution to the *P&B* service (first row and first column of table 1, choice task 1) and that their customers would most likely want them to contribute a cost equal to 176 Eurocents (first row and second column of table 1, choice task 1). But in the subsequent choice tasks (generated as orthogonal variations from the first base case), shopkeepers choose alternatives that make them pay on average 71 Eurocents, slightly more than what stated in the first task. How much do customers think shopkeepers should contribute to the *P&B* cost

financing? The interviewees stated that they would accept to use the *P&B* service if shopkeepers would pay on average 175 Eurocents, a strikingly similar figure to the one stated by shopkeepers (shopkeepers know their customers well!). In the agreement cases, that is when the same *P&B* scehario is chosen by both parties[10], shopkeepers accept to pay on average 72 cents. The bargaining area for shopkeepers' contribution to the *P&B* cost financing can consequently be estimated to be between 68 and 175 Eurocents.

b) Costs to be borne by customers. On average, in the first task (second row and first column of table 1, choice task 1), shopkeepers stated that customers should contribute 139 Eurocents per parcel for the *P&B* service. They also expect that their customer would most likely want to contribute a cost equal to 29 Eurocents (second row and second column of table 1, choice task 1). The analysis of the choice tasks stated by customers, in fact, shows that they are willing to contribute on average 28 Eurocents (again, shopkeepers know their customers well!). The *P&B* alternatives chosen by both parties are those in which customers pay on average 46 Eurocents. The bargaining area for customers' contribution to the *P&B* cost financing can consequently be estimated to be between 28 and 139 Eurocents.

c) Maximum delivery time at the parking lot. On average, in the first task, shopkeepers stated that a parcel should be delivered at the parking lot within 60 minutes. They also stated that their customers would most likely want a parcel to be delivered in 45 minutes. The analysis of the choice tasks, however, shows that shopkeepers are willing to accept an average time of 109 minutes and customers a surprisingly higher time of 117 minutes. When a *P&B* alternative is chosen by both parties the delivery time is on average equal to 103 minutes. The bargaining area for the delivery timing can consequently be estimated to be between 60 to 117 minutes, as customers appear to be less demanding then it is perceived by the shopkeepers.

4. Econometric results

The stated preference data of shopkeepers and of their customers have been used to separately estimate two different logit models, one for each group, hence the initial pass power model has been estimated.

The shopkeepers' choice model

None of the shopkeepers participating to the SP experiment (19 out of 21[11]) refused to begin the negotiation process, that is chose the third alternative described in table 1. The estimates of the parameters of the binomial logit model based on their choices are reported in table 2.

[10] Out of the 266 tasks (14 tasks times 19 interviews), in 53 of them the customer chooses the same alternative chosen by the shopkeeper without having previous information on the latter's choice.

[11] Two shopkeepers asserted that P&B service was unsuitable for their business, hence they did not provide the necessary starting values for designing the experiment.

Table 2: The shopkeepers' choice model.

Variable	*Coefficient*	*t-statistics*
Alternative specific constant	0.102	0.37
Cost to be charged to the shopkeeper	-3.319	-5.70
Cost to be charged to the customer	-0.640	-1.68
Maximum delivery time at the parking lot	-0.012	-3.60
Use of information technology	0.361	1.27
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	-0.871	-2.23
Extra-cost to be charged to customers for a destination other than the parking lot	0.698	2.15

Notes: N. obs.: 266; LL(B)= -74.03; Adjusted Pseudo R^2 (no coefficients)=0.40851.

The overall performance of the model is quiet good. The most significant parameter is the service cost to be borne by shopkeepers, and, as expected, it has a negative sign. Maximum delivery time at the parking lot has also a negative effect on shopkeepers' utility function. They probably perceived that the quickness of the service would increase the competitiveness of the stores located in the city center. Surcharges for parcels to be delivered at destinations other then the parking lot positively affect shopkeepers' utility function if this extra service is paid by customers, the opposite if the shopkeepers have to pay for them. The parameter of the customers' contribution to the cost of the *P&B* service has a negative sign, most likely because shopkeepers believe that it would reduce their competitiveness, but this estimate has limited statistical significance. Finally the use of information technology is viewed positively, but the estimate of this parameter is characterized by low statistical significance.

The customers' choice model

Since during the SP experiment some customers chose the third alternative, that is they refused both the proposed hypothetical *P&B* services, we decided to use a nested logit in order to model their behaviour. Specifically, we structured the model as tree composed by two branches: a branch, with two twigs, describing the choice between the hypothetical *P&B* services, and a degenerate branch (single twig) describing the choice of not participating to the *P&B* service (figure 1).

The result is a highly significant model according to which customers are particularly sensitive to the *P&B* cost which, according to their preferences, should be paid by the shopkeepers. All the other variables are not significant, including, quite surprisingly, the maximum delivery time at the parking lot.

Table 3: The customers' choice model.

Variable	*Coefficient*	*t-statistics*
Alternative specific constant	6.700	1.87
Cost to be charged to the shopkeeper	3.925	1.93
Cost to be charged to the customer	-3.427	-1.91
Maximum delivery time at the parking lot	0.003	0.45
Use of information technology	-0.829	-1.09
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	1.492	1.47
Extra-cost to be charged to customers for a destination other than the parking lot	0.634	0.87
No-service alternative specific constant	20.867	0.24
IV parameters		
SI	2.45	2.05
B(1|1,1)	2.29	.240

Notes: N. obs.: 266; LL(B)= -15.37; Adjusted Pseudo R^2 (no coefficients)= 0.88389.

The initial pass power model

On the bases of the coefficients estimated for the shopkeepers and for the customers with the models previously described, and following the MIGI methodology, we have estimated an initial pass power model.

For this estimation we used only the tasks where one of the hypothetical *P&B* services were chosen, excluding, thereof, 12 tasks in which customers chose the "non-option", that is the third alternative in table1. As stated by Hensher and Puckett (2006) the initial pass power model can be estimated considering: a) all the choice tasks, independently of the fact that both parties choose the same alternative or not (complete first pass model), or b) only those choice tasks in which the two parties choose the same alternative (restricted first pass model).

The estimation of the parameters of the complete first pass model, that is the τ_s in equations 2, produced the following results:

According to the model specification, a coefficient τ larger than 0.5 signals that shopkeepers exert a stronger influence then their customers on the value of the attributes characterizing the *P&B* service, while a τ smaller than 0.5 signals a stronger influence of customers. As in Hensher and Puckett (2006), and contrarily to the theory, we consider "unbounded" τ parameters (they are free to exceed the 0-1 boundaries), because we assume that a party might trade off his influence on one attribute with its influence on another one. Hence, the interpretation of the results is the following.

Shopkeepers retain control over their contribution to financing the service, but customers exert an even stronger influence on their contribution. Surprisingly, the quickness of the service is more influenced by shopkeepers rather than by customers. Such a result is consistent with what derived from the previous descriptive and analytical evidence of the data: quickness is not an important attribute for the sampled customers.

Similarly, information technology is a feature deemed more important by shopkeepers than by customers. With reference to whom should pay for the extra-cost of home delivery, the estimates provide a balanced influence on shopkeepers contribution,

whereas customers contribution is very much influenced by shopkeepers preferences. Both results appear quite reasonable since the service under consideration is very much in the interest of the customers and, consequently, the parties favour a solution in which the extra-cost is borne by the customers.

Table 4: Complete Initial Pass Power Model.

Mean power measures τ (>0.5 represents relative power to shopkeeper, <0.5 represents relative power to customer)	*Coeficient*	*t-ratio**
Cost to be charged to the shopkeeper	0.808	2.12
Cost to be charged to the customer	-1.060	-4.11
Maximum delivery time at the parking lot	1.163	2.43
Use of information technology	0.979	1.44
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	0.517	0.07
Extra-cost to be charged to customers for a destination other than the parking lot	1.587	2.93
Constant (shopkeeper chooses 1, customer chooses 1)	-0.479	-2.50
Constant (shopkeeper chooses 1, customer chooses 2)	-0.619	-3.39
Constant (shopkeeper chooses 2, customer chooses 1)	-0.712	-2.90

Notes: * The null hypothesis is H_0:$\tau = 0.5$.
N.obs: 254; LL(B)= -100.11; Adjusted Pseudo R^2 (no coefficients)= 0.71.

In order to estimate the restricted version of the initial pass power model two sets of data are available: one including only the agreement choices and one which comprises those tasks where customers were willing to revise their first choice in order to reach an agreement with the shopkeepers. In our interviews both situations are not numerous. Out of 266 tasks, 53 resulted in immediate agreement, while 11 in situations where customers were willing to revise their choice and accept the shopkeepers' choices. Since the data resulting from the first 53 tasks were not enough to estimate the model, this was estimated combining the initial and the subsequent agreement cases.

Table 5: Restricted Initial Pass Power Model.

Mean power measures (>0.5 represents relative power to shopkeeper, <0.5 represents relative power to customer)	Coefficient	t-ratio*
Cost to be charged to the shopkeeper	0.476	-0.11
Cost to be charged to the customer	-0.838	-2.40
Maximum delivery time at the parking lot	1.463	2.48
Use of information technology		
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	0.134	-1.15
Extra-cost to be charged to customers for a destination other than the parking lot	0.733	0.30
Constant (shopkeeper chooses 1, customer chooses 1)	-0.536	-2.20
Constant (shopkeeper chooses 1, customer chooses 2)	-2.446	-4.81
Constant (shopkeeper chooses 2, customer chooses 1)	-2.189	-3.81

Notes: * The null hypothesis is H_0:$\tau = 0.5$.
N. obs.: 64 choice tasks (53 first-agreement cases + 11 second-agreement cases); Information technology variable not considered; LL(B)= -42.24; Adjusted Pseudo R^2 (no coefficients)= 0.50320.

The model could be estimated with all the variables used in the previous models except the use of information technology. The results are similar but not equivalent to the previous ones (those obtained with the complete version of the initial pass power model), demonstrating that the two models have a different meaning.

They indicate that the shopkeepers' contribution is equally influenced by the two parties, unlike the previous result. On the contrary, customers retain a great influence in determining their contribution. The quickness of the service is left to shopkeepers as in the previous model. The contribution to the extra-cost is influenced by customers in the case of shopkeepers' contribution and vice-versa in the case of customers' contribution. Unlike the previous results, customers are less willing to accept the surcharge for home delivery.

The probability of agreement

It is also interesting to estimate how attributes affect the probability of agreement between the two parties. It can be done using the information obtained from the tasks where an agreement (either direct or after concession by the customer) took place.. The alternatives are described by the attributes levels and the alternative chosen by both parties is set to 1. The model contains the same amount of information as the restrictive initial pass power model with the difference that it is specified using the attribute levels as follows.

$$y_j = \alpha_j + \beta' X_j + \varepsilon_j \tag{4}$$

Where y_j is set to 1 when the alternative j is chosen by both parties and 0 otherwise. The results are presented in Table 6.

Table 6: Probability of agreement.

Variable	Coeff.	Std.Err.	t-ratio
Cost to be charged to the shopkeeper	-6.367	3.367	-1.89
Cost to be charged to the customer	-8.508	3.169	-2.68
Maximum delivery time at the parking lot	-0.024	0.008	-2.90
Use of information technology	0.645	0.606	1.06
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	0.909	0.693	1.31
Extra-cost to be charged to customers for a destination other than the parking lot	0.195	0.722	0.27
Constant	-0.454	0.603	-0.75

Notes: N. obs.: 64 choice tasks (53 first-agreement cases + 11 second-agreement cases); LL(B)= -19.36; Adjusted Pseudo R^2 (no coefficients)= 0.50.

It turns out that the increase in the minutes within which the parcel is made available at the parking lot affects negatively and significantly the probability of both parties agreeing on choosing the alternative. Notice the high coefficients attached to the cost to be charged to the customers or to the shopkeepers. They are both negative meaning that an increase in cost has a negative impact on the probability of both parties agreeing on the alternative. Both variables have also high standard errors (because of the conflicting

interests among the two parties) resulting in low t-statistics. However, it turns out that the t-statistics (and also the coefficient) for the cost to be charged to the shopkeeper is actually lower than that of the customer, meaning that an increase in the cost to be charged to the shopkeepers affects less the probability of having an agreement then an increase in cost to be charged to the customers. All other variables are not statically significant and can be interpreted as playing a minor role.

Simulative results

In the descriptive results section the levels of the alternative preferred by the shopkeepers and by the customers were identified and discussed. They are summarised in the first three rows of Table 7. The remaining three variables are coded as dummies (meaning that both alternatives use of information technology, alternative A requires extra-cost to be charged to the customers and alternative B to the shopkeepers). How likely is that the alternative A and B so described are accepted relative to one another? The application of the coefficients estimated with the four models (the shopkeepers' choice model, the customers' choice model, the complete initial pass power model and the agreement-only initial pass power model) provides us with an estimate of their relative degree of acceptability.

Table 7: Simulation.

Attributes	Alternative A: Preferred by shopkeepers	Alternative B: Preferred by customers
Cost to be charged to the shopkeeper	0.71	1.75
Cost to be charged to the customer	1.39	0.28
Maximum delivery time at the parking lot	109	117
Use of information technology	1	1
Extra-cost to be charged to the shopkeeper for other destinations	0	1
Extra-cost to be charged to customers for other destinations	1	0
Models:	*P(A)*	*P(B)*
Shopkeepers' choice model	99%	1%
Customers' choice model	0%	100%
Complete initial pass power model	1%	99%
Agreement-only initial pass power model	0%	100%

It turns out that alternative A is highly preferred by shopkeepers, whereas it has no chance of been accepted by customers. The opposite is true for alternative B. This results is obvious since each party prefers his own alternative. But what about the dyad's preferences. The complete and the agreement-only initial pass power model deem definitely more acceptable to the dyad the customers' preferred alternative then the shopkeepers' preferred alternative, meaning that the compromise solution deriving from a bargaining process would most likely be closer to alternative B than to

alternative A. But the model cannot tell us neither how close these alternative are to the compromise solution, nor which will be the compromise solution.

Alternative specifications of the group utility function

Because of limited sample size we were able to estimate only the specification of equation 3 , those including the direct interaction terms (all but the one relative to cost to be charged to the shopkeepers).

The model adopting the multi-linear specification of the group utility function (equation 3) is slightly superior to the linear utility model of equation 1. But none of the intra-group interaction parameter proves significant, although their signs are, in general, correct. A positive sign implies that the group utility rises when one party systematic utility improves holding the other party's utility constant (signalling positive group inter-dependence or complementarity). A negative sign implies that the group utility decreases when one party systematic utility improves holding the other party's utility constant (signalling negative group inter-dependence or substitutability). The only interaction term with a positive sign is the quickness of the service, since both party profit from its increase. On the contrary, and not surprisingly, cost variables have a negative sign, signalling conflict. Surprisingly, the information technology interaction term has a negative sign as well.

Table 8: The multi-linear group utility function.

Mean power measures (>0.5 represents relative power to shopkeeper, <0.5 represents relative power to customer)	Coeff.	t-ratio*
Cost to be charged to the shopkeeper	0.854	2.26
Cost to be charged to the customer	-1.117	-3.87
Maximum delivery time at the parking lot	0.718	0.39
Use of information technology	-0.105	-0.74
Extra-cost to be charged to the shopkeeper for a destination other than the parking lot	0.573	0.15
Extra-cost to be charged to customers for a destination other than the parking lot	1.990	3.42
Interaction term relative to the cost to be charged to the customer	-0.340	-2.32
Interaction term relative to the quickness of the service	1.114	0.45
Interaction term relative to the use of information technology	-3.852	-1.52
Interaction term relative to extra-cost to be charged to the shopkeeper	-0.096	-0.92
Interaction term relative to extra-cost to be charged to the customer	-1.869	-2.09
Constant (shopkeeper chooses 1, customer chooses 1)	-0.390	-2.15
Constant (shopkeeper chooses 1, customer chooses 2)	-0.443	-1.66
Constant (shopkeeper chooses 2, customer chooses 1)	-0.437	-1.58

Notes: * The null hypothesis is H_0:$\tau = 0.5$.
N. obs.: 254; LL(B)= -96.79; Adjusted Pseudo R^2 (no coefficients)= 0.72.

5. Conclusions and future research agenda

The paper analyses the potential for introducing an innovative city logistics service in the city of Pesaro (Italy), a P&B service along the lines of the pilot project introduced in Siena in 2004. The idea is to organize a service to deliver the parcels bought in the stores of the traffic-restricted city center to the parking lots where the customers are forced to leave their cars or where their coaches are parked.

In order for the service to be successful, both shopkeepers and costumers need to be willing to use it and to share, at least partially, its costs. Furthermore, the characteristics of the service, that is quickness, use of ICT, destination to be served, etc., should be as much as possible consistent with the preferences of its users.

This paper attempts to empirically evaluate the preferences of the parties involved in the *P&B* service via a stated preference experiment. Since the success or failure of this service is based on the interaction of at least two parties, shopkeepers and customers, group decision theory and group decision making models have been used to design the SP experiment and to analyze the data.

Attribute levels are not pre-fixed by the researcher but set by the shopkeeper, with orthogonal variations on the base alternatives. The same experiment is then administered to his potential customers, without or with previous knowledge on the shopkeeper's choice.

The descriptive and econometric results show that most shopkeepers (19 out of 21) are interested in the implementation of the *P&B* service and are willing to make a proposal on its characteristics and cost distribution. Customers are also interested in the introduction of the new service.

The two parties' preferences about cost allocation, although, are, not surprisingly, quite different. While the shopkeepers' willingness to contribute to the *P&B* costs ranges between 68 and 175 Eurocents, the customers' willingness to pay ranges between 28 and 139 Eurocents. 60 to 117 minutes is the time within which a parcel should be made available at the parking lot. Table 9 represents a summary of the econometric results obtained.

Table 9: Summary of econometric results.

	Shopkeepers.	*Cust.*	*Full PM*	*Re. PM*
Variable	β	β	τ	τ
Cost to be charged to the shopkeeper	-3.319 (-5.7)	3.925 (1.93)	0.808 (2.12)	0.476 (-0.11)
Cost to be charged to the customer	-0.64 (-1.68)	-3.427 (-1.91)	-1.06 (-4.11)	-0.838 (-2.4)
Minutes within which the parcel should be available at the parking lot	-0.012 (-3.6)	0.003 (0.45)	1.163 (2.43)	1.463 (2.48)
Use of information technology	0.361 (1.27)	-0.829 (-1.09)	0.979 (1.44)	
Extra-cost to be charged to the shopkeeper for other destinations	-0.871 (-2.23)	1.492 (1.47)	0.517 (0.07)	0.134 (-1.15)
Extra-cost to be charged to customers for other destinations	0.698 (2.15)	0.634 (0.87)	1.587 (2.93)	0.733 (0.3)

Note: t-stat in parentesis.

Independent discrete choice models, one for shopkeepers only and one for customers only, are estimated. The former indicates that shopkeepers regard their contribution to the service as the most decisive factor. They attribute importance to the quickness of the service as well as to the distribution of the surcharge for destinations other than the parking lot, which they deem should be borne by customers. To some surprise their customers' contribution to the cost of the service enters negatively their utility function, so that they deem it should be reduced as much as possible, most likely because they fear an indirect negative effect on their business.

Customers' choice model is mainly determined by cost allocation. Contrary to the shopkeepers, the cost attributed to them affects negatively their utility function while that allocated to shopkeepers affects their function positively. Furthermore, they believe that the extra-costs of other than parking lot destinations should be borne by shopkeepers.

In order to estimate the influence that their preference structure plays on the bargaining process, two types of initial-pass power models are estimated as proposed in the literature: a complete power model and an agreement-only power model. The former indicates that shopkeepers exert a greater control over their contribution to the financing of the service, the quickness of the delivery (to some surprise), the surcharge attributed to the customer and the use of information technology. Customers exert more influence on the share of their direct contribution only. The agreement-only power model offers a slightly different view. Shopkeepers loose control on their direct contribution, whereas customers retain theirs. It is confirmed that the timing of the delivery is influenced by shopkeepers, whereas customers push for a shopkeepers' contribution to the extra-costs of home delivery and shopkeepers push for customers' contribution.

An enhanced version of the power model allowing the identification of potential altruistic effects did not detect any intra-group interaction effects.

The data collected allowed us also to estimate the determinants of the probability of agreement. The results of our analysis show that the cost of the service, especially for the customers, and the quickness of the service negatively affects the probability of agreement. Information technology, on the contrary, does not seem to play a relevant role.

Finally, a simulation was performed to estimate which of the alternatives preferred by shopkeepers and by customers were more able to succeed. Our analysis showed that the alternative proposed by customers is more likely to be closer to the final compromise solution, or, stated in other terms, shopkeepers seem more likely to concede to customers' desires. However, the methodology is not able to forecast which will be the end result of the interaction process.

To conclude, the paper presents a methodology to evaluate the potentialities of a new city logistics service. Although various theoretical and methodological issues are still open to discussion, the methodology demonstrates to be useful in providing insights not only the parties' preference structure as normally achieved by discrete choice models, but also on the shopkeepers perception of customers' preferences, on the area of bargaining, on each party's influence on the choice attributes and on the determinants of the probability of achieving a comprise solution.

In future research we would like to extend the analysis to different cities both to enlarge the sample size and to verify if there are different perceptions in various parts of the country. A larger sample size should also allow us to estimate different functional

forms of equation 3 as well as to estimate a restricted power model with initial pass elements only. More sophisticated discrete choice models will also be estimated.

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