On the value of crowding in public transport for Ile-de-France

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Abstract

This paper presents a study which was carried out in the Paris Ile-de-France region to quantify the value of crowding and comfort in public transport. The aim was to provide robust valuations of crowding and comfort that could be used to appraise the benefits of major public transport projects. The study addressed all public transport modes available in Ile-de-France, and has gone through the steps of a classical valuation project: (1) literature review, (2) qualitative research, (3) large-scale stated preference (SP) survey and analysis, and (4) validation against revealed preference (RP) data and results found elsewhere. For all public transport modes together we found that the discomfort due to crowding can be expressed in a travel time multiplier with values ranging between 1.1 (when all seats are taken) to 1.6 (when the vehicles are absolutely packed, value for standing passenger). These results are broadly in line with those of other research carried out in France, but lower than the values that were obtained for rail in the UK.

Keywords: appraisal; crowding; public transport; stated preferences.

Résumé

Cette communication présente les résultats d’une étude menée en Ile-de-France pour quantifier de manière robuste la valeur accordée à l’affluence et au confort dans les transports collectifs en vue d’une utilisation pour l’évaluation des projets d’infrastructures de transports collectifs. Elle s’est intéressée à tous les modes de transports collectifs en Ile-de-France et a suivi les étapes classiques pour une telle étude: (1) bibliographie, (2) étude qualitative, (3) enquêtes de préférences déclarées (SP) et analyse des résultats, (4) comparaison avec les préférences révélées (RP) et les résultats d’autres études. Pour l’ensemble des modes de transports collectifs, l’étude a montré que l’inconfort lié à l’affluence pouvait être exprimé via un facteur multiplicatif du temps de trajet compris entre 1.1 (quand tous les sièges sont occupés) et 1.6 (valeur pour les passagers debout quand le véhicule est complètement plein). Ces résultats sont du même ordre que ceux trouvés dans d’autres recherches réalisées en France mais plus basses que des valeurs obtenues pour le train interurbain au Royaume-Uni.

Mots-clé: évaluation; affluence; transports collectifs; préférences déclarées

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Introduction

Since the mid 90's, public transport patronage in Île-de-France (the Paris region) has increased substantially: over the last decade alone a 20% growth was observed. This growth, even though it was an aim of the Sustainable Urban Mobility Plan adopted in 2000, was not completely anticipated. Consequently, the capacity is on some parts of the network in the dense central area of the region, no longer sufficient to meet the demand during the peak hours. This results in over-crowded vehicles and waiting times for passengers at rail platforms.

Renewal of the rail infrastructure and rolling stock is necessary to cope with this situation. But renewal alone will not be enough. Major investments are planned to increase capacity by either building new lines, or by increasing capacity of existing lines. The Grand Paris Express is the best known of these projects. Furthermore, a number of bus lines will be transformed into tramway lines, railway lines are being renovated, and new automatic systems for railway operation will allow shorter headways between subsequent trains, and thus more capacity. All these projects together should reduce the shortage of capacity substantially by 2020, and totally eliminate it by 2030. As a consequence, crowding levels in public transport will be highly reduced.

For the socio-economic appraisal, it is necessary to quantify all impacts of these investments. The impact on travel and waiting times can be determined by using standard traffic models, such as the ANTONIN model that is used in the Île-de-France area. The reduction in congestion levels can also be forecasted by using more advanced traffic models. However, little is known about the value that passengers attach to these reduced congestion levels (for a review of existing literature, see section 3), and hence the benefits associated with this.

Therefore, STIF, public transport authority in Ile-de-France, commissioned Significance in 2011 to conduct a study focused on the perception and valuation of comfort inside public transport vehicles in general, and more particularly on the issue of crowding. This study was to cover all modes of public transport in Île-de-France.

1. Objectives and research approach

The study reported here aimed at estimating the perceived value of crowding in public transport vehicles in Île-de-France. Different values for each available public transport mode had to be derived, where necessary. All results had to be valid for the Île-de-France. The final values were to be used in cost-benefit analyses appraising the socio-economic effects of public transport projects; and in passenger demand forecasting models predicting mode choice and route choice by public transport users in Île-de-France.

The research approach used for this study consisted of four phases:

- The first phase included a literature review of French and international scientific publications on the value that public transport passengers attach to comfort and particularly to crowding inside the vehicles.
- The second phase was a qualitative investigation of the key factors driving the perception of comfort by different categories of public transport passengers.
- The third phase consisted of the design, execution and analysis of a stated preference survey, to derive coefficients on the value of comfort. Comfort was considered in all its dimensions, but specific focus was put on crowding. In addition to the stated preferences surveys, questions were asked about the passengers' attitudes towards public transport, which resulted in a typology of the respondents.
- The fourth phase consisted of a revealed preferences survey to verify the results of the stated preferences survey. Passenger counts and interviews were carried out at different rail stations to measure the proportion of passengers actually preferring to wait for the next vehicle instead of taking the (more crowded) first vehicle.

The present publication concentrates on the estimation of the value of crowding inside public transport vehicles.

2. Literature review

The literature review demonstrated that only limited knowledge was available about consumers' valuation of crowding inside France, while the value of comfort is almost an entirely new subject. But also outside France the literature on the subject is fairly limited. Li and Hensher (2011) reviewed the international literature available until then, and Wardman and Whelan (2011) provided a synthesis of 20 years of rail crowding valuation studies carried out in the UK. Earlier work included Douglas Economics (2006) which reported results of rail oriented stated preference research carried out in New Zealand. Other earlier crowding work included Cox et al. (2006), Baker et al. (2007), Oxera (2007), MVA (2007) and Whelan and Crocket (2009). In France two studies reporting crowding results could be mentioned: a recent one by Haywood and Koning (2011), and a slightly older one by Kroes et al. (2006). Here we just summarise the French studies.

In Paris, Haywood and Koning (2011) reported their study about "Pushy Parisian Elbows" along part of metro line 1 in Paris. Using contingent valuation the authors quantified the passengers' trade-off between crowding and travel time. They found that metro passengers were prepared to travel on average 8 minutes longer per trip to reduce the high peak hour level of crowding to the substantially lower level of crowding experienced outside the peaks. This is roughly equivalent to a value of about 1.5 euro per trip, which is clearly non-negligible.

Also in Paris, but a few years earlier, Kroes et al (2006) conducted research based upon SP experiments for travel on interurban rail lines. Although the study aimed primarily at measuring the value of punctuality, it also produced penalties for travelling under crowded circumstances, which were expressed as minutes of equivalent travel time. For commuting to central Paris, for instance, they found that the penalty for travelling standing was equal to 4.9 minutes per trip plus 0.3 minute per minute of travel time. So a 20 minute trip would have a penalty of 10.9 minutes additional perceived travel time.

The literature review concluded that there are a number of common elements emerging from the literature:

- Crowding inside public transport vehicles generates substantial disutility, which adds to the generalised cost of travel;
- The research that has been conducted into the valuation of crowding has almost exclusively used Stated Preference data to estimate the values. This is likely to be related to the fact that it is extremely difficult to find real-life situations where passengers can be observed to trade crowding against travel time or cost;
- Most studies express the disutility of crowding using a travel time multiplier, which is a function of the level of crowding, and which is different for seated and standing passengers.

3. Qualitative research

In order to learn more about the key factors driving the perception of comfort (crowding and other elements of comfort) in public transport vehicles, and in order to prepare for the Stated Preference surveys in our study, five focus-group discussions were organized. These consisted of young adults, frequent commuters, occasional and non-commuter traveller's, seniors, inhabitants of more remote suburbs.

The group discussions aimed specifically at understanding passenger's perception of physical comfort inside all types of public transport vehicles in order to identify which dimensions and features are important, and what consequences discomfort has on behaviour. Comfort while waiting at platforms and bus stops was not included in this project.

It was found that the perception of physical comfort in public transport covers a range of aspects including crowding, stability of the vehicle, seat comfort, temperature, smells, noise, comfort when standing, ease of access, and ease of on board circulation. For each aspect of comfort, participants were asked to define what a *perfect*, a *correct*, an *uncomfortable* and an *unbearable* level was. Table 1 shows the results for the aspect of crowding.

Table 1: Levels of perception with respect to crowding

	Level of perception			
	Perfect	Correct	Uncomfortable	Unbearable
Descriptive	"there are a few persons"	"almost all seats are occupied. A few people are standing, one can move easily"	"all seats are occupied. There are people standing, it is not easy to move"	"all seats are occupied. Standing passengers are next to each other"
Impact on passenger	"one can stay where one wants"	"one can choose where to stand but not choose one's seat"	"one has to stand but has a little space to move. One can stay near the seats to be able to sit when one gets free or near doorways to exit easily"	"one cannot move"

Behaviours to avoid discomfort that were quoted during the focus groups were:
- Letting one or two vehicles pass by before boarding, especially for modes with little capacity (bus) or with a high frequency (metro);
- Changing itinerary, even if the alternative itinerary is longer and/or requires more transfers;
- Changing the timing of travel, which includes leaving home earlier in the morning for commuters;
- Changing position inside the vehicle.

The results of the qualitative study were used to clarify the questionnaires of the stated preferences study, especially with regard to the presentation of crowding levels to the respondents.

4. Stated preference research

In order to appraise *a-priori* the perceived benefits of future reductions of crowding levels in public transport, it is necessary to know what economic value passengers attach to specific improvements. One way to estimate this value is to conduct a "stated preference" choice experiment (see eg. Louviere et al. 2000). In such an experiment a sample of passengers is offered a series of choices between two (or more) hypothetical alternative public transport services. These services differ in some key characteristics, such as travel time, waiting time for the next service and level of crowding inside the vehicles. Passengers are asked to state their preferences for one of the alternatives. In the Île-de-France project it was decided to choose this methodology to conduct the research.

The design of the stated preference survey was based upon previous experience with crowding research reported in the literature (e.g. Li and Hensher 2011, Kroes et. al. 2006, and Wardman and Whelan 2011) and the qualitative research reported in section 4. Some of the main elements are summarised below.

4.1. The choices and choice variables

In order to prevent biases, we designed two different choice experiments to measure the value of crowding.

In SP1 six choices were offered between taking a crowded service immediately, and waiting for the next service that would be less crowded. Each choice differed in the level of crowding of the immediate and next service (both were specified using eight possible levels) and the waiting time (five levels), An example of such a choice is given in Figure 1.

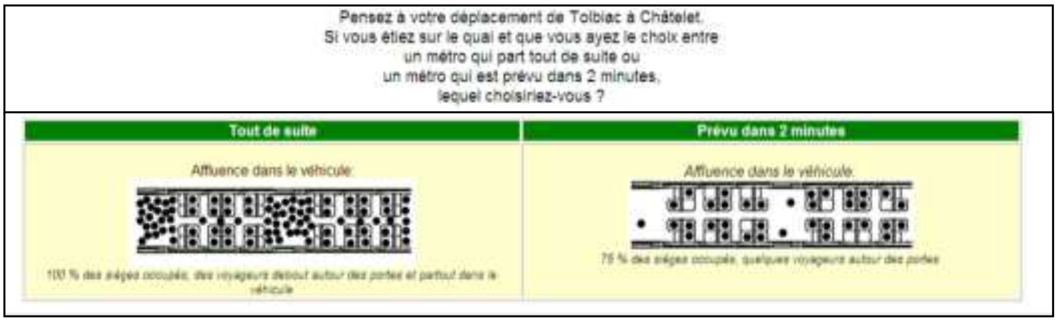

Fig. 1. Example of a choice situation from the SP1 experiment

In SP2 six choices were offered between taking a very crowded train with a short travel time, and taking a less crowded train with a longer travel time. Additionally, for each alternative it was specified whether the respondent would be able to find a seat, or that (s) he had to stand. Each choice differed in the level of crowding of the both services (each had eight possible levels), in the travel time (each had eleven possible levels, pivoted on the reported (current) travel time of the respondent), and in the possibility of finding a seat. An example is given in Figure 2.

Fig.2. Example of a choice situation from the SP2 experiment.

4.2. The presentation of crowding

Based upon the literature and the tests conducted during the qualitative research, the eight different levels of crowding were presented by means of both a graphic presentation and a description. Both were adapted to the mode of transport used by the respondent: different presentations were used for rail modes (metro, RER, train, tram) and for the bus.

4.3. The sample

In total 3,000 public transport users participated in the stated preference survey. They were recruited among the members of a large internet panel. Respondents had to live inside Île-de-France, and had to have made a journey by public transport recently. They were spread over the different passenger segments that were under investigation. These segments differed by public transport mode used, residential area, age category, gender and working status (active versus non-active).

The recruited public transport users were interviewed by internet, using a personalised questionnaire based upon their reported travel characteristics for a recent journey. The interviews took place between September and December 2011.

5. Analysis of stated preferences

When analysing the responses of the respondents, we noted that a relatively large percentage of the public transport passengers indicated that they were prepared to wait a few minutes in order to travel in a less crowded vehicle: from 13% when the current vehicle is hardly crowded to 75% when the current vehicle is absolutely packed and the next vehicle has seats available. We found this percentage intuitively rather high.

We analysed the choices of the public transport users in the stated preferences experiments to derive the utility weights of each of the service quality variables using discrete choice analysis methods – in this case simple logit analysis based upon maximum likelihood estimation (see eg. Ben-Akiva and Lerman 1985). We have tested a large number of different model specifications. Here we report only some of the most interesting findings.

5.1. Crowding level of first vehicle versus next vehicle

In a first very simple model we estimated only the following coefficients on data from SP1 only:

- seven constants for the crowding levels (level 2 – 8) of the first vehicle. The lowest level was constrained to zero;
- seven constants for the crowding levels (level 1 – 7) of the next vehicle. Again, the lowest level was constrained to zero;
- a linear coefficient for the waiting time between the first and next vehicle;
- and a constant which indicates an intrinsic preference to wait for the next vehicle (i.e. an alternative specific constant).

All coefficients had the expected sign and all were highly significant. The sensitivity of the coefficient to the crowding level of the first vehicle was much greater than that of the next vehicle. The passengers appeared to base their choice primarily on the crowding level of the first vehicle to come, as can be seen from Figure 3. Note that in this Figure the crowding coefficients have been divided by the waiting time coefficients to give a vertical scale that can be easily interpreted. A small jump in both the value of the crowding of the first and the next vehicle can be observed between crowding levels 4 and 5, which is exactly the transition to a situation where the traveller can no longer sit if he wants to.

The constant had a value equivalent to 5.2 minutes of waiting time. This can be interpreted as a strong preference to wait for the next vehicle, all other things being equal. Whether this is a real effect, or a statement from the respondents that they are very unhappy with crowded vehicles, is unclear at this point in the analysis.

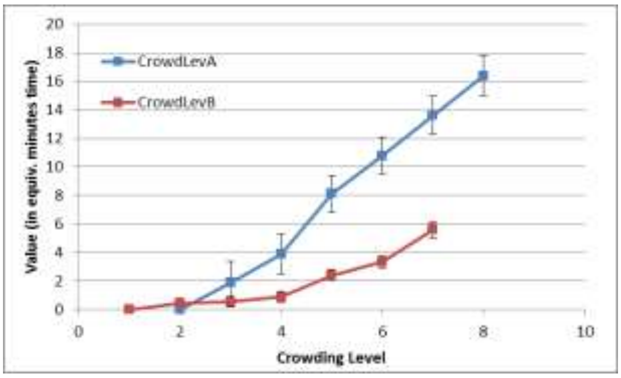

Fig.3. Estimated coefficients on crowding

5.2. Constant value per trip versus travel time multiplier

To express the disutility of crowding one can use a single constant value (or penalty) per trip, as was done in the previous paragraph, or one can use a travel time multiplier value. The first type of specification assumes that the crowding effect is irrespective of the duration of travel, the second specification assumes that the crowding effect is proportional to the travel time. The last specification seems intuitively appealing: the longer the journey, the more important it is to travel comfortably. On the other hand it is rare for travellers making long journeys not to find a seat at some stage during the journey, so the crowding does not produce a constant nuisance during the whole journey.

Therefore, we estimated two other models, a “constants” model and a “proportional” model, again on data from SP1 only, with the following coefficients:

- seven coefficients on travel time, each interacting with a crowding level (level 2 – 8) of the first vehicle. The lowest level was constrained to zero;
- seven coefficients on travel time, each interacting with a crowding level (level 1 – 7) of the next vehicle. Again, the lowest level was constrained to zero;
- a linear coefficient for the waiting time between the first and next vehicle;
- a constant indicating an intrinsic preference to wait for the next vehicle;
- and a coefficient on travel time, indicating an intrinsic preference to wait for the next vehicle that is proportional to travel time.

It was clear that the "constants" model fitted the data much better than the "proportional" model, even though the "proportional" model had one additional coefficient. For the SP2 we came to the same conclusion. We also tested a combined model with both constants and coefficients proportional with travel time.

This result is remarkable in that almost all studies in the United Kingdom and several studies conducted elsewhere use the travel time multiplier value to express the disutility of crowding.

5.3. Simultaneous estimation using SP1 and SP2

We have estimated separate models for SP1 and SP2, and then we have tested a single joint model using both data simultaneously. It turned out that the resulting values of crowding were not significantly different between both experiments for any of the crowding levels, provided that we used separated scale factors for both SP experiments to account for differences in error. Consequently we have used the simultaneous model specification for deriving the final application coefficients.

A few words about the different time variables that were included in SP1 and SP2: SP1 contained waiting time, and SP2 contained travel time. The ratio between the coefficients for waiting time and travel time was found to have the value of 1.37, which may seem a bit low but is broadly of the expected order of magnitude.

5.4. Coefficients for application

Having observed that the constant crowding effect per trip provided a better explanation of the stated choices than the travel time multiplier value, we have nevertheless derived a set of coefficients for application usage based upon the multiplier specification. Crowding penalties that are proportional to travel time can easily be added to the models that are used for appraisal purposes, whereas constant penalties are much more difficult to apply in practice. This has to do with the use of public transport assignment software, and the uncertainty about the application of constants for interchanges (does one apply a bus penalty once or twice for a bus-bus interchange?). Also for application in cost-benefit analyses we often know the occupancy rate between different stops, but not the exact numbers of passengers boarding/leaving at each station.

The resulting multipliers for application usage were derived for all modes together but also separately for metro, train+RER (i.e. regional rail), bus and tram. The results are given in Table 2. Note that we have based these values upon the crowding level of the first vehicle only.

Table 2 Travel time multipliers as a function of the level of crowding for different public transport modes in Île-de-France

Crowding level	All modes		Metro		Train+RER		Bus+Tramway	
	Seated	Standing	Seated	Standing	Seated	Standing	Seated	Standing
1	1.000		1.000		1.000		1.000	
2	1.000		1.000		1.000		1.000	
3	1.000		1.000		1.000		1.000	
4	1.083		1.077		1.073		1.102	
5	1.165	1.289	1.155	1.270	1.145	1.261	1.204	1.342
6	1.248	1.394	1.232	1.362	1.218	1.358	1.307	1.467
7	1.330	1.499	1.309	1.453	1.290	1.456	1.409	1.593
8	1.413	1.604	1.386	1.545	1.363	1.553	1.511	1.718

These multipliers can be compared to the multipliers found by Wardman and Whelan (2011) for (longer-distance) rail travel in the United Kingdom. For crowding levels 5, 6, and 7 standing they found respectively 1.97, 2.19 and 2.69, substantially higher than our values (see Figure 4).

Our results cannot be directly compared to the previous studies in Paris (Haywood and Koning 2011, Kroes et al. 2006), since these researches did not derive travel time multipliers. However, we have converted our final values into similar units as used in these studies, and from this comparison it turned out that our values were in agreement with those results.

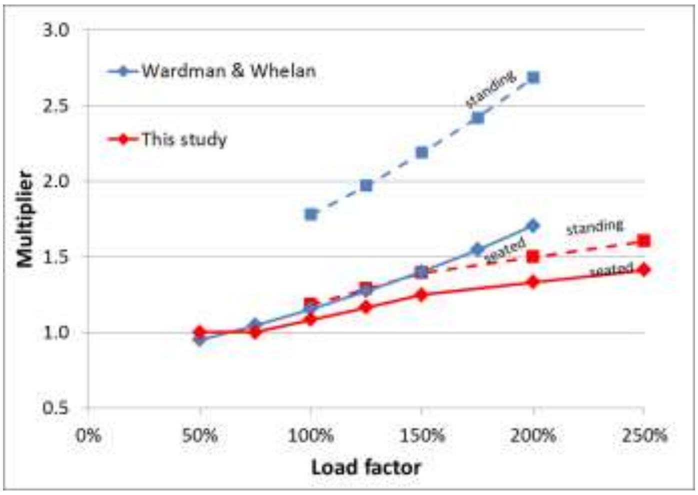

Fig 4: Comparison between multipliers obtained in this study and those reported by Wardman and Whelan 2011

6. Revealed preference research

We have looked for possibilities to verify the findings of our SP survey in a real-world (or Revealed-Preference) situation. We identified some locations where public transport travellers were making trade-offs between waiting time and level of crowding, somewhat comparable with the choice situations in SP1. Just before the metro stations Maison Blanche and Tolbiac (line 7) and just before the RER station Vincennes (line A) two branches of the same railway line come together. These branches have the same frequency of service, but very different passenger numbers. As a result, crowded and less-crowded metros/trains are alternating systematically during the morning peak (in the direction of the city centre). Passengers who are familiar with these locations can be expected to be aware of this alternating pattern, and hence the fact that very crowded trains are likely to be followed by a much less crowded train.

During 12 days, we counted both the number of passengers that boarded the crowded trains directly, and the number of passengers that waited for the next (less-crowded) train. This allowed us to determine the percentages of waiting passengers in reality, as a function of the crowding level of the arriving train and the next train, and with a short waiting time between subsequent trains. We interviewed travellers about their reasons for waiting, in order to correct the observed percentages for those people who waited for valid reasons which had nothing to do with the crowding level (e.g. destination not served by certain trains). The resulting percentage of passengers waiting (after correction) varied from 0% when the current train was hardly crowded to some 25% when the current train was absolutely packed, see Figure 5.

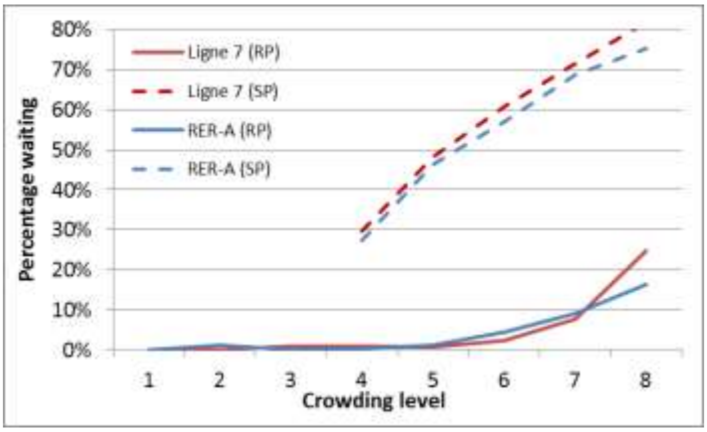

Figure 5: Percentage of passengers waiting for next train as a function of crowding level of current train

Figure 5 also shows the percentage passengers waiting as derived from the SP models. It appears that the percentages of passengers observed to wait in reality are substantially lower than those obtained from the SP data. So there seemed to be a substantial difference between the SP answers and the RP observations. In the next section we discuss possible reasons for this.

7. Discussion and resulting values of crowding

The question now is what values should be used for application for socio-economic evaluation: the values derived from the seemingly high SP-percentages or values derived from the substantially lower RP-percentages? After some reflection we came to the following reasoning.

There are a number of reasons why it might be useful, and even necessary to correct the results of our SP experiments for application in a CBA context: the possibility of SP bias, the fact that the SP questions assumed constant crowding during the entire journey, and the fact that in the SP questions respondents are 100% certain about crowding level of current and next vehicles and the exact waiting time.

There are also several reasons why the RP data may show a relatively low number of passengers waiting: not all passengers will have known that the next train was likely to be less crowded, in reality passengers have no certainty about the waiting time and about the crowding level of the next train. So in reality only those passengers who were very experienced might decide to wait, and they would still have uncertainty about what their cost (waiting time) and benefit (improvement in crowding level) would be. This would lead to less passengers waiting relative to the theoretically ideal situation to determine the value of crowding, which would be measured when there is certainty about the variables that are being traded (waiting time versus reduction in crowding level).

On the balance, the SP data may be subject to error, but the direction and the size of the error are unclear. The RP data, however, are also not likely to show the number of people that would be waiting in the case of an ideal trading situation for measuring the value of crowding. So we cannot really compare.

When it comes to answering the question which results, based upon SP or based upon RP data, comes closest to providing the pure value of crowding for cost-benefit analysis, we are inclined to give the following answer:

- The real value of crowding is likely to be somewhere between the values provided by the SP data and the RP data, but theoretically the real value of crowding could be even higher than the SP values;
- It is extremely unlikely that the real value of crowding will be lower than the RP values; quite the opposite, the value based upon the RP data are almost certainly too low an estimation of the real value of crowding;
- On the balance, we feel that the value based upon the SP data is likely to be closest to the real value of crowding.

So we concluded that the SP values were to be used for socio-economic evaluation.

8. CONCLUDING REMARKS

The most important findings of this research are:

- We found that passengers' decisions to wait for a less crowded public transport vehicle were primarily determined by the level of crowding of the first vehicle to arrive. The (announced) crowding level of the next vehicle appeared to be much less important;
- We found that a constant utility per trip specification provided a clearly better fit to the stated choice data than the travel time multiplier specification commonly used in literature. Despite this better fit we have chosen for a multiplier specification for our application coefficients. This choice, however, was entirely based upon practical reasons, the ease of application, rather than upon data-based evidence;
- We found that the heterogeneity between different groups of passengers was fairly limited.
- We found that revealed preference data suggested a lower willingness to wait for less crowded vehicles than the stated choice data suggested. However, there are many reasons why it is likely that the RP data underestimated the real willingness to wait, and therefore we kept the values derived from the stated choices without any downward adjustment;

- The values of crowding that we found were broadly in agreement with those obtained in two other studies carried out in the Île-de-France region. Compared to the values found for rail travel in the UK, however, they were substantially lower.

It is clear that more value of crowding studies, conducted in similar and different contexts, are needed before more definitive and more general conclusions can be drawn with respect to the value of crowding in public transport. In the meantime, our results will be used for cost-benefit evaluations of transport projects in the Île-de-France region.

References

Baker, J., Murphy, P. and Myers, N. (2007): Placing a value on overcrowding and other rail quality factors, European Transport Conference.

Ben-Akiva, M. and Lerman, S. (1985): Discrete Choice Analysis, Theory and Application to Travel Demand, MIT Press.

Cox, T., Houdmont, J. and Griffiths, A. (2006): Rail passenger crowding, stress, health and safety in Britain, Transportation Research: part A, 40, 244-258.

Douglas Economics (2006): Valuing the Cost to Passengers of Train Crowding, Report to RailCorp, April 2006.

Haywood, L. and Koning, M. (2011): Pushy Parisian Elbows: Evidence on Taste for Travel Comfort, Paris School of Economics, Paris.

Kroes, E. Kouwenhoven, M. Duchateau, H. Debrincat, L. and Goldberg, J. (2006): Value of Punctuality on Suburban Trains to and from Paris, Transportation Research Record, TRB 2006.

Li, Z. Hensher, D. (2011): Crowding and public transport: A review of willingness to pay evidence and its relevance in project appraisal, Transport Policy, 18 (2011), 880-887.

Louviere, J., Hensher, D. and Swait, J. (2000): Stated Choice Methods, Analysis and Application, Cambridge University Press.

MVA (2007): Understanding the Passenger, Valuation of Overcrowding on Rail Services, Report for Department of Transport.

Oxera (2007): How to value in-work-time crowding, prepared for Department of transport.

Wardman, M. and Whelan, G. (2011): Twenty years of Rail Crowding Valuation Studies: Evidence and Lessons from British Experience, Transport Reviews: A Transnational Transdisciplinary Journal, 31:3, 379-398.

Wardman, M. (2012): UK Preference Valuations of Soft factors: How Credible are the Results?, Institute for Transport Studies, University of Leeds.

Whelan, G. and Cricket, J. (2009): An Investigation of the Willingness to Pay to reduce Rail Overcrowding. In: Proceedings of the first International Conference on Choice Modelling, Harrogate, England, April 2009.