User reactions towards differentiated pricing schemes in urban transport -

Implications for their implementation

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A substantial proportion of the costs associated with transport is not borne by the users responsible, but is externalised, effectively being subsidised by the general public or later generations. If people do not have to bear the full cost of their journeys, they will not take this into account when making decisions on travel. This carries the risk of the existing infrastructure becoming overused. If the perceived price of a journey is too low, this leads to a high demand for transport. Pricing policies, such as inner-city toll charges or parking pricing, may be a way of countering this increase in demand. Economically, the best pricing model would be dynamic and highly differentiated, depending on a variety of factors such as different times, locations, distances, emissions and driving styles, in order to achieve the desired changes in behaviour. In contrast to this theory, a large number of empirical studies have shown that such complex pricing models are too hard for users to understand and predict, and therefore fail to achieve the desired mobility behaviour (e.g. Bonsall 2009; Rößger 2008; Engelmann 2009). A multitude of pricing elements can make these schemes harder to use. This makes it imperative to take psychological considerations and user needs into account if goals are to be met. This discrepancy between differentiated pricing structures and user confusion at the interface between economy and psychology is examined more closely in this thesis.

Only those differentiated pricing systems that are understood and accepted can reduce external costs and relieve urban areas, by influencing travellers to drive less or choose sustainable alternatives over the private car. The central research question investigated in this paper is therefore to what extent users are willing and able to deal with differentiated pricing systems in urban transport, to understand them and to react as desired. To answer that question, it is firstly necessary to establish which factors influence reactions to differentiated pricing schemes. To this end, a variety of adjustments were made to the differentiated pricing systems themselves. Secondly, an analysis was made of the degree to which individual differences may influence users' reactions to differentiated pricing models, and lead to significant variations in reactions to certain price signals. Three urban fields of application were investigated and compared: inner-city tolls, parking fees and public transport fares. This approach made it possible to show differences in the way users deal with and assess differentiated pricing models across all these forms of transport. A further aim of this paper is to derive concrete, practical recommendations, showing how differentiated a pricing model can be in order to influence users' decisions and lead to more eco-friendly behaviour. This includes suggestions on how to design such pricing schemes to be socially acceptable and how to embed them within other measures. The aim, therefore, is to use these findings to help design measures that induce the most positive user reaction to price signals, thus also enabling the redistribution of external costs more fairly among the users responsible.

To address the research questions, a mixed method design was chosen. Three laboratory studies were carried out and evaluated on travellers' reactions to differentiated pricing

schemes when applied to inner-city tolls (n = 155), parking fees (n = 79), and public transport fares (n = 62): how users dealt with such schemes, their intended behaviour and their acceptance of the schemes. An interview (n = 21) and a field study at parking ticket machines (n = 91) were also carried out. All the questionnaires used for the laboratory studies are similar in structure, using the same methodical approach to enable comparison of the results and evaluation of the data set as a whole. They each consist of three parts: general questions on mobility behaviour and the participant's experience with pricing systems, then a test on the participant's knowledge of pricing, their reaction times and mathematical abilities, followed by the main component, where the participant is asked to calculate or estimate the cost incurred using a variety of pricing models. The most important variables to emerge are the latency time (the time the test subject takes to answer), their subjective certainty of their answer, the probability of error, their awareness of the problem and their intended behaviour. In order to detect any differences between various sections of the population, care was taken that the samples were as heterogeneous as possible. In the inner-city toll experiment, the influence of learning effects and of rounded versus irregular numbers was also examined. The field study at the parking ticket machine was conducted to complement this. The study relating to public transport united the various principles of different pricing schemes, such as e-tickets, and investigation of behavioural characteristics into one study design.

As hypothesised, these studies concluded that the test participants calculated the cost more slowly and were more prone to error as the complexity of the pricing systems increased. They perceived the pricing schemes to be more difficult to comprehend, and were less confident of their own understanding and less sure in their calculations. Another finding regarding inner-city toll systems, which matches those of previous research, is that spatially differentiated schemes are judged easier to understand than temporally differentiated models. Car drivers in general prefer a flat monthly fee. Although the test sample included a high number of young and well-educated people, differences between subgroups showed that older participants needed more time and were more prone to error. Presenting toll pricing systems in order of increasing complexity resulted in lower latency times and error rates than presenting them in random order: this can be interpreted as a learning effect. Across all pricing schemes, regardless of the participant's behavioural intentions and the means of transport under investigation, it was shown that a moderately differentiated pricing system was the most likely to induce behavioural changes. Knowledge of which factors play a role in decision-making among users may aid in devising appropriate pricing systems.

Via cluster and factor analysis, three user groups were identified. These groups differed in two essential dimensions: ability and motivation. In addition, carrying out the studies in the city centre was also shown to have an influence, particularly relating to evaluation of acceptance: inner-city toll charges were calculated more poorly, probably due to strategic response behaviour on the part of the users.

The following recommendations result from these studies: (1) any pricing system should be structured simply and understandably, i.e. comparable prices should be given in commonly used standard units and irregular prices should be avoided, (2) two degrees of differentiation seem to suffice (at least initially) to influence transport behaviour, as this enables learning effects to occur, (3) users should be provided with an objective overview of all mobility options and their costs, e.g. via smartphone apps or on-board units, (4) no disadvantages should arise for particular groups of users, e.g. older or less educated travellers, from the use of differentiated pricing schemes, (5) differentiated pricing systems should represent just one measure within an overarching mobility strategy, in order to reach the whole of society, and (6) the "lessons learnt" from this research should be evaluated and documented, so that further measures can be implemented with (greater) success.

References

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