Influences of infrastructure and attitudes to health on value of travel time savings in bicycle journeys

Gunilla Björklund[1], Reza Mortazavi[2]
[1]Swedish National Road and Transport Research Institute (VTI)
& Centre for Transport Studies
[2]Dalarna University

When planning road and rail investments, cost benefit analysis (CBA) is a common method used by authorities both to design the infrastructure and to prioritize between different investment projects. According to Börjesson and Eliasson (2012; The value of time and external benefits in bicycle appraisal. Transportation Research Part A, 46, 673–683.), two possible reasons for the lack of CBA in bicycle investments are that the methodology is less developed for bicycle trips than for road and rail, and the implicit perception that cyclists have so low willingness to pay for time savings or other improvements that bicycle investments need to be motivated by "additional" benefits in the form of increased health, environmental effects, or reduced road congestion. To increase the knowledge in this subject, Börjesson and Eliasson performed a study aimed at estimating valuations of different cycling facilities and at assessing the magnitude of health effects and (to a lesser extent) benefits from reduced car traffic.

The main purpose of the present study is to further examine the importance of different kinds of bicycle environments (mixed traffic, bicycle field in the road way, bicycle lane next to the road, and bicycle lane not in connection with the road) in the estimation of values of travel time savings. A second purpose is to further investigate how attitudes to health and exercise in connection with cycling influence these values. The results are based on two stated choice studies carried out in four cities in Sweden. In the first study, the "handed-out" study, the questionnaires were handed out to cyclists when they actually were cycling. In the second study, the "mailed-out" study, the questionnaires were sent home to persons in the same cities in order to receive responses from commuters, both regular cyclists and potential cyclists.

The empirical models that are estimated are versions of the following specification:

$$V_b = \alpha_b + S\theta - \kappa_{bdhf}\left(\sum_{d=1}^{2}\sum_{h=1}^{2}\sum_{f=1}^{4}(T_b \times d \times h \times f)\right) + \sum_{d=1}^{2}(\kappa_d T_d) + \sum_{d=1}^{2}\lambda_d C_d + \varepsilon_b \quad (1)$$

Each respondent had in twelve stated preference choices to decide whether they would have cycled or taken an alternative travel mode, but to simplify notations we have here disregarded from the panel data dimension and the individual indexing. Equation (1) is the indirect utility function for choosing bicycle (hence the letter b as the index here). α_b is the alternative specific constant for bicycle. S is a vector of some individual specific variables such as gender, educational level and living status and θ is the vector of parameters measuring the

effect of these factors on utility. d is a dummy variable indicating whether the relevant alternative mode for the individual is public transport or car.

h is a dummy variable separating the participants who considered health aspects as important in their choice to take the bicycle and participants who considered health aspects as less important. In the questionnaire, the respondents were asked to state on a five-point scale (1 = No importance at all, 5 = Very large importance) how important a number of factors are in their decision to choose bicycle as travel mode. The items regarding health, safety, and flexibility/comfort were analysed in a confirmatory factor analysis with these three factors as latent variables. A confirmatory factor analysis tests how well some observed (in this case, self-reported) variables function as indicators for an underlying, latent variable. In this paper we only use the scores for the latent variable for health. Although the latent variable is continuous, we have chosen to transform it into a dummy variable (representing high and low in attitude regarding health and cycling) because of the problems with including continuous latent variables in more advanced choice models. The health variable is based on following questions regarding exercise/health and cycling: ”A time-efficient way to exercise”, “A good way to keep weight/lose weight”, “Improves fitness”, and “Good for one’s own health”.

f is a nominal variable indicating the cycling environment that was presented in the stated choice part. Variable T, measures travel time for each travel mode and variable C measures the travel cost for car and public transport.

In Table 1 and 2, the values of travel time savings from the handed-out study respectively the mailed-out study are presented.

Table 1. Values of travel time savings in the handed-out study (SEK/h)

	Value of travel time saving n = 1,250	
Infrastructure and health attitude	Alt.travel mode car	Alt. travel mode PT
Cycle time mixed traffic		
Health high	305 (253-358)	167 (142-191)
Health low	344 (286-402)	198 (171-226)
Cycle time BC field		
Health high	308 (254-361)	173 (148-198)
Health low	347 (289-406)	201 (172-229)
Cycle time BC lane, next to road		
Health high	204 (167-242)	107 (88-126)
Health low	285 (236-333)	150 (127-172)
Cycle time BC lane, far from road		
Health high	179 (145-213)	92 (74-110)
Health low	280 (232-329)	133 (112-154)
Alternative travel mode	145 (108-182)	66 (43-89)

PT = Public transport

Table 2. Values of travel time savings in the mailed-out study (SEK/h)

	Value of travel time saving n = 672	
Infrastructure and health attitude	Alt.travel mode car	Alt. travel mode PT
Cycle time mixed traffic		
Health high	247 (204-290)	131 (107-155)
Health low	305 (252-357)	127 (104-150)
Cycle time BC field		
Health high	253 (208-297)	145 (119-172)
Health low	316 (261-371)	139 (114-163)
Cycle time BC lane, next to road		
Health high	164 (132-195)	75 (55-95)
Health low	248 (203-292)	100 (79-121)
Cycle time BC lane, far from road		
Health high	151 (121-181)	60 (42-78)
Health low	234 (192-276)	95 (75-114)
Alternative travel mode	158 (122-195)	59 (35-84)

PT = Public transport

The results suggest that regular and potential cyclists value cycling on bicycle lanes higher than they value cycling in mixed traffic or in bicycle fields, at least in these hypothetical situations. Surprisingly, the respondents in this study do not consider cycling on a lane next to the road worse than cycling on a lane not in connection to the road, indicating that they do not take traffic noise and air pollution into account in their decision to cycle. They do not differ between cycling on a road way and cycling in a bicycle field in the road way either. One reason can be that the respondents are not custom to bicycle fields, which foremost exists in larger cities.

The results also indicate that respondents that include health aspects in their choice to take the bicycle have lower values of travel time savings for cycling than respondents that state that health aspects are of less importance. The health aspects seem to have greatest effect when cycling on a bicycle lane. However, one must be aware that this is one of the first attempts to investigate the individual's own appraisal of an imagined or actual health effect regarding cycling and there is some noise in the results.

It is clear that the appraisals of travel time savings regarding cycling differ a lot depending on the alternative travel mode the respondents have given. The individuals with car as their main alternative transportation mode have much higher values of travel time savings than the persons stating public transport as the main alternative. This difference can to some degree be explained by a smaller income for the latter, but it is far from the whole explanation.