

EXERCISE SESSION 13

An analyst is interested in modeling a mode choice problem between car and public transportation (PT) in a large city taking into account the effect of attitudes such as discomfort of using public transportation (*AttAntiPT*) and environmental concern (*AttProEnv*). In this context, an integrated choice and latent variable model is appropriate in order to account for the effects of the attitudes on mode choice.

The analyst is designing the survey for the data collection. She will collect information about the characteristics of the individuals and the observed attributes of the alternative modes, which are exogenous explanatory variables, as well as *attitudinal indicators* for the latent variables model. To obtain these indicators, she proposes statements and asks the respondent to position himself about it, using a scale ranging from -2 (totally disagree) to 2 (totally agree). Two indicators related to each attitude are collected. The two indicators related to the attitude *AttAntiPT* are noted I_{1n} and I_{2n} and the two indicators related to *AttProEnv* are noted I_{3n} and I_{4n} .

1. In the specification of the choice model the analyst has considered the effect of: i) cost, ii) time, iii) number of children, iv) frequency of public transportation (Figure 1). Complete the diagram in Fig. 1 in order to integrate the effect of the two latent variables in the choice model. Make sure to use appropriate shapes and arrows and explain the drawing convention, i.e. what do the different shapes and arrows represent.
2. Update your diagram once more (use Fig. 2), assuming that people with high education level and people who own a bike have a pro-environmental attitude, while people with low education level and owning more than one car have an attitude against public transportation.
3. Write down the structural equations corresponding to the a) *choice* and b) *latent variable* models, accordingly.
4. Write down the measurement equations corresponding to the a) *choice* and b) *latent variable* models, accordingly. Consider the specification of the updated diagram obtained in sub-question 2. Take into account that the collected indicators are discrete. What would the structural equations be if the collected indicators were continuous? Is there any normalization necessary?

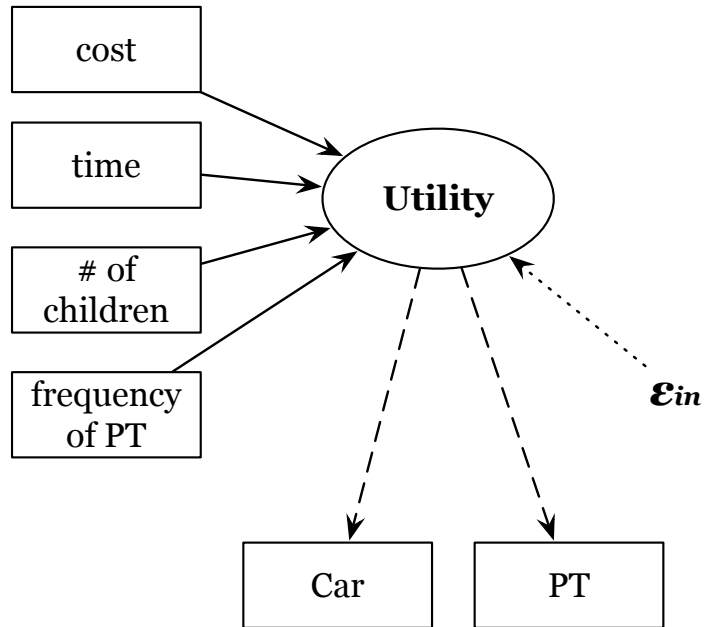


Figure 1: Specification diagram of the standard mode choice model.

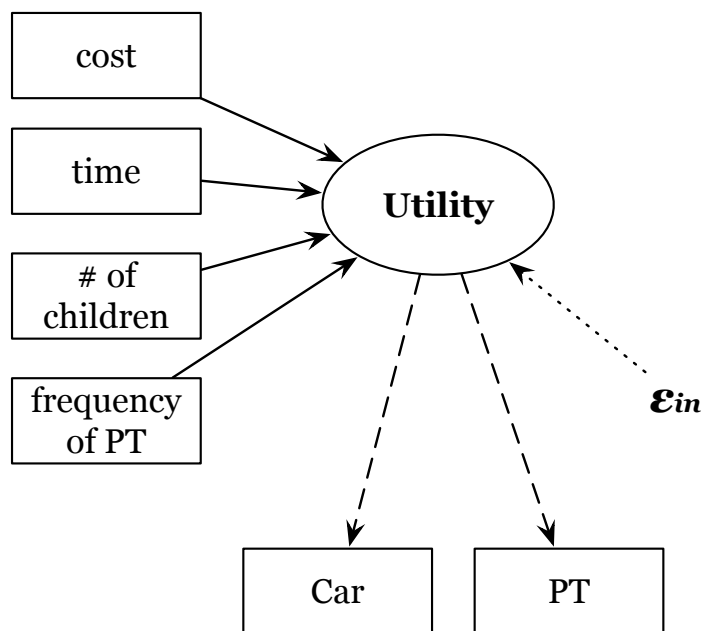


Figure 2: Specification diagram of the standard mode choice model.