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Modelling and observing the effects of long distance bus market liberalization in Germany

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Abstract

Since January 2013 the long-distance passenger market is open to bus operators. This paper is about the efforts of the German railway company in market research and model building to predict the effect of bus market liberalisation in advance. Methods, forecast and the real development of the bus market will be shown. The major focus is the design of the situational stated preference conjoint and the parameter estimation of the mode choice model.

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Keywords: long distance bus, long distance rail, market liberalization, modal split model, travel demand forecast, mode choice study, choice based conjoint, revealed preferences, stated preferences, choice parameter estimation

1. Introduction

Between 1934 and 2012 long distance scheduled bus services in competition to railway were prohibited within Germany, with the exception of Berlin for historical reasons. The aim of this market restriction was the protection of public railroad infrastructure investments. Since January 2013 the long distance passenger market is completely open to bus operators to offer scheduled services for journeys longer than 50 km where the railway travel time is above one hour. Offer and demand has grown rapidly and is still growing in the third year of liberalisation.

Since 2002 DB FV (Deutsche Bahn Fernverkehr, German Rail Long Distance Passenger Transport) uses and elaborates the four stage travel demand forecasting model PRIMA for the economic evaluation of time table scenarios. This paper is about the research, methods and results of integrating the long distance bus to the mode choice stage of the travel demand model PRIMA.

Section 2 gives a short introduction into PRIMA. Section 3 is about the market research started in 2012 in order to be able to forecast the effects of liberalisation in advance. Section 4 is the main chapter and shows the method and some results of the estimation of the mode choice parameters. Section 5 tells about bus market observations in terms of offered services, prices and network. Section 6 shows the long distance bus demand and the loss of rail demand as predicted by PRIMA. Section 7 presents our ideas for future research. Section 8 summarizes the paper together with main learnings resulting from our experiences.

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2. PRIMA – The DB FV Travel demand forecasting model

PRIMA (Prozessunterstützung im Angebotsmanagement, Support of Supply Management) is a highly automated system for the economical evaluation of DB FV timetable scenarios. The costs of a timetable result from vehicle need and use, the revenues are predicted by a travel demand model. The PRIMA travel demand model is a classical (Ortuzar and Willumsen 2011) four stage model with a major focus on mode choice and assignment

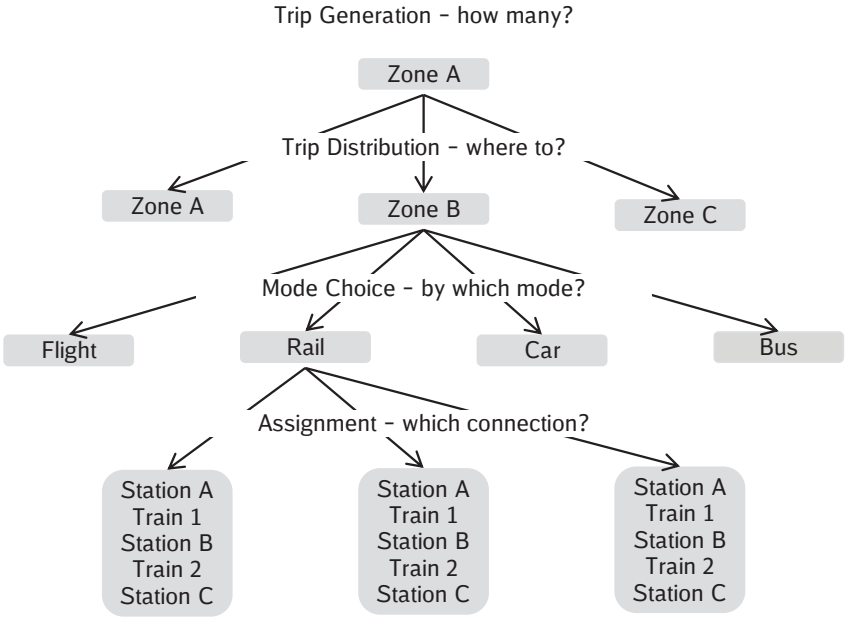

Fig. 1. Structure of the Four Stage Travel Demand Model PRIMA

Trip Distribution, mode choice and assignment are classical discrete choice models, where the traveler has to choose between alternatives with different level of service, mainly measured by the attributes travel time, price, transfers and adaption time.

The adaption time is the difference between the preferred departure time of the traveler and the actual departure time given by the timetable of a scheduled service, adaption time of private car is 0 since it is anytime available. So adaption time is reciprocal to frequency.

As distribution and assignment, the mode choice model is of multinomial logit type (Ben Akiva and Lerman 1985 or Ortuzar and Willumsen 2011). Here is the probability $p_i$of a mode i to be chosen:

$$p_i = \frac{e^{U_i}}{\sum_{j\in\{modes\}} e^{U_j}}$$

Where the Utility U_i of that mode depends on the values $x_{i,k}$ of the attributes k:

$$U_i = \sum_{k\in\{attributes\}} \beta_{i,k} \cdot f\left(x_{i,k}\right) + c_i$$

The ß-parameters $\beta_{i,k}$ and the mode specific constants c_i have to be estimated by a mode choice study. In a simple linear logit model there is always

$$f\left(x_{i,k}\right) = x_{i,k}$$

Here the modal split depends on the difference of the attribute values.

In the Kirchhoff model:

$$f\left(x_{i,k}\right) = \ln(x_{i,k})$$