A logit model for shipment size choice with latent classes – empirical findings for Germany and discussions

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Extended abstract

Objectives and motivation
Modeling the choice of shipment size is a canonical aspect in developing a freight transport model which also considers logistic choices. The embedding of the shipment size choice into the mode choice explains a large proportion of the otherwise unobservable variance and therefore enables the identification of further characteristics with systematic influence. Based on the development of a discrete shipment size choice model for road transports as a first step a consistent conjunction between logistic choices and the discrete mode choice can be realized. Since there exists a huge variety of shippers the induced behavioral heterogeneity should be taken into account. As the integration of underlying industrial sectors and logistical attributes leads to insufficient explanatory power and an inflation of the model in the statistical sense the identification of behaviorally homogeneous groups is considered to be able to reduce the heterogeneity satisfactorily.

General description
The observations of the used dataset were collected via computer assisted personal interviews (CAPI) with responsible logistics employees of logistics-related companies. The chosen enterprises were sampled from a German-wide business directory with about 10,000 addresses whereby unsuitable members of the sample were excluded through a multicriteria screening. In each interview two representative transports and the corresponding attributes are ascertained. Based on the categorization of the shipment sizes into three classes (piece goods, partial loads and (multiple) full loads) and the application of the Economic-Order-Quantity-Model (EOQ-Model) a Multinomial Logit Model with 487 observations is estimated. The identification of the behaviorally homogeneous groups is realized by an attribute-based latent class analysis (LCA) approach. The identified latent classes are subsequently integrated into the Multinomial Logit Model.

Results and conclusions
The EOQ-Model as the core of the shipment size choice for road transports explains a major proportion of the prevalent variance. The signs and the magnitudes of standard influencing variables are plausible and as expected. Only the influence of the cost of capital is smaller than predicted by the classical EOQ-Model. This effect is already described in the literature and we try to give explanations based on logistics considerations. The LCA based on the attributes of the transported goods revealed four latent classes which could be denominated as (temperature-controlled) food products, special goods, unpacked bulk goods and miscellaneous standard cargo.

References

Keywords: freight transport; shipment size; Economic-Order-Quantity; discrete choice; latent class