Authors' Response to Reviews of

Evaluating the Impacts of Parameter Uncertainty in a Practical Transportation Demand Model

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RC: ***Reviewers' Comment***, AR: Authors' Response, ☐ Manuscript Text

We are grateful for the reviewer's comments on this manuscript. We address each point in turn, with text added to the manuscript in blueand ~~text deleted from the manuscript in red~~.

1. Reviewer #2

1.1. Introduction

RC: ***This manuscript presents a detailed investigation into the impacts of parameter uncertainty in a practical, trip-based transportation demand model using the Roanoke Valley Transportation Planning Organization (RVTPO) model as a case study. By employing Latin Hypercube Sampling (LHS) to explore parameter variations and their impact on traffic forecasts, the research addresses a critical issue in transportation modelling: the robustness of parameter uncertainty in realistic scenarios. In sum, the study provides a clear methodology and robust results, showing that parameter uncertainty has a minimal effect on traffic volumes in this specific model. The findings contribute to the understanding of uncertainties in transportation demand forecasting and their implications for decision- making in infrastructure planning. From the point of view of relevance and originality, I think the paper tackles a timely topic, as accurate transportation demand forecasts are essential for policy and infrastructure planning. It particularly focuses on parameter uncertainty, a less explored but highly impactful area within transportation modelling literature.***

AR: We are grateful for the reviewer's positive comments on the originality and timeliness of this research.

1.2. Literature Review

RC: ***While the literature review covers a broad range of studies, it could be more focused. For instance, the review mentions several papers that primarily address input data or model form uncertainties, which are less relevant to the paper's primary focus on parameter uncertainty. A deeper dive into recent studies specifically addressing parameter uncertainty in trip-based models or activity-based frameworks would strengthen the contextual relevance.***

AR: We agree with this general point, but feel it is important to highlight that research has largely been focused on things other than parameter uncertainty, which we identify in the paper's Introduction as the only element of modeling addressed by classical statistics.

This comment did, however, cause us to investigate some interesting modern research in the application of Bayesian statistics to model development and calibration. We have added a brief discussion in the literature review,

1.3. Methodology

RC: ***I also consider that the methodology employed by the authors to assess parameter uncertainty is comprehensive and adequate. Their use of Latin Hypercube Sampling (LHS) to construct hundreds of combinations of parameters across a plausible parameter space allows for a more efficient sampling of the parameter space compared to simple random sampling, ensuring that the entire range of possible values is explored. This is a notable strength, as well as their evaluation across multiple trip purposes and the inclusion of high- volume and low-volume network links, to provide a comprehensive sensitivity analysis. The authors also introduced substantial changes to implied travel impedances and modal utilities based on the sampled parameter combinations, allowing them to observe the effects on traffic volume forecasts.***

AR: We are glad that the reviewer found this to be a strength of the paper, and we agree that it leads to the strongest contribution of the paper.

1.4. Results

RC: ***In my opinion the results are well-structured, with clear presentation in tables and graphs. The conclusion—that parameter uncertainty contributes minimally to forecast variation compared to network and model constraints—is supported by quantitative evidence. In fact, the study's findings suggest that efforts to address uncertainties in travel forecasting may be better spent on improving model specifications and input data accuracy rather than focusing solely on parameter uncertainty.***

AR: We are happy that the reviewer found our results persuasive in light of the evidence we submit.

1.5. Minor Comments

1.5.1 Practical Impacts

RC: ***The abstract effectively summarizes the study, but including a line on the practical implications of the findings would enhance its appeal.***

1.5.2 Coefficient of variation

RC: ***The paper assumes a coefficient of variation (CV) of 0.10 for parameter uncertainty. While the authors justify this with a rational range for value of time, the choice could be further validated with sensitivity tests or references to empirical studies. In Table 3, the coefficient of variation for non-motorized and transit trips is substantially higher than for auto trips. This observation could be highlighted and discussed in the results section to emphasize differences in confidence across modes.***

1.5.3 Limitations

RC: ***The authors note that the RVTPO model's size and constraints may limit the generalizability of the findings. However, further discussion on how these limitations impact other models, especially in large urban or multimodal contexts, would add depth.***

1.5.4 Future research

RC: ***The conclusion section could expand on how these findings might influence future research priorities or practical applications in urban transportation planning.***

1.5.5 Equation and figure discussion

RC: ***Certain equations, such as those describing mode and destination choice, could benefit from additional explanation or context to ensure accessibility to readers unfamiliar with specific modelling practices. Figures, while generally effective, could include more explicit labels or annotations for non-specialist readers. Figure 3 on trip density by mode is insightful but could be paired with more textual analysis to discuss patterns by trip purpose or link volume.***

1.5.6 Other sources of uncertainty

RC: ***The study primarily addresses uncertainty related to mode and destination choice parameters, without exploring the statistical uncertainty in trip production estimates. This omission could mean that other significant sources of uncertainty affecting traffic volumes are not adequately considered.***

RC: ***Finally, the paper does not delve deeply into other sources of uncertainty, such as input data inaccuracies or model specification errors, which could also significantly impact forecasting accuracy. A more comprehensive analysis of these factors could provide a fuller understanding of the uncertainties involved in transportation demand modelling.***

1.5.7 Static assignment constraint

RC: ***The research suggests that the static network assignment may constrain the possible volume solutions, potentially limiting the practical impacts of parameter uncertainty. This raises questions about the generalizability of the findings to more dynamic or less constrained network scenarios.***

1.5.8 Trip-based model

RC: ***The findings are based on a specific trip-based travel demand model, which may not be applicable to all contexts or regions. The results might vary significantly in different geographic areas or under different modelling frameworks, such as activity-based models.***