Response-to-reviewers_R1

2023-10-18

Thank you for for the time and care taken by the editorial team and reviewers in providing feedback to this manuscript. No doubt, the revised version submitted is more articulate than the first. We've provided extensive feedback to all comments from each reviewer in blue and directly quoted the revised portion of the manuscript as relevant in *italicized blue*

Reviewer #1:

The article extends the concept of spatial accessibility and applies it to a fairness analysis of different modes of transportation. The article uses travel data from a week in Madrid as an example to analyze spatial accessibility in the city. However, the article has the following issues:

1. Lack of Innovation: The article's improvement on spatial accessibility mainly involves incorporating the ratio of travel frequencies as weight in travel costs. This improvement is relatively minor and the method used does not demonstrate superiority over traditional accessibility approaches.

We disagree.

2. Insufficient Experimental Data: The article uses questionnaire data from a week in Madrid, but lacks basic descriptions of the questionnaire data. Additionally, the daily travel data of approximately 30,000 trips is significantly limited, and there is no description of the criteria for selecting the dates. The typicality of the experimental data is questionable.

We disagree.

3. Lack of Data-Driven Analysis: In the analysis section, a large amount of data is used to analyze people's travel behavior in different areas. The analysis of spatial accessibility only considers the differences in the modes of travel mentioned earlier. The analysis results are somewhat one-sided, and examining the indicator from multiple perspectives would provide a more objective view. It is recommended to expand the dimensions of the analysis.

4. Disorganized Format: The article's methodology section contains numerous formulas and variables, but the definitions of these variables are unclear and difficult to read. There are also numerous formatting errors, and Table 1 is disorganized and unappealing. It is recommended to revise these issues.

Reviewer #2:

This paper has sound mathematical foundations and allows to answer its research question in an elegant way (how to measure competition for e.g. jobs based on spatial accessibility?). I also really appreciated the fact that the paper was very didactic. Still, I have concerns about the relevance of the paper for future research.

More specifically, the new measure proposed by the authors has clear limitations: i) it focuses on the competition for jobs and is not useful for studying access to non-competitive or semi-competitive resources such as amenities. ii) it doesn't allow to study absolute gains or losses in accessibility from public transportation infrastructure improvements or changes. iii) the authors do not allow for modal shifts: they assume that the transport mode choice of households is fixed and cannot evolve due to e.g. transport infrastructure changes. These points limit the relevance of the new accessibility measure. The authors should, at least, specify these limitations early in the paper. The introduction should start by stating the precise research question the new accessibility measure is seeking to answer as well as its limitations). They should also justify, based on the

literature, that competition for jobs is a key determinant of job market outcomes, and that there is strong inertia in mode choices.

Finally, the writing of the paper, and particularly of the abstract and introduction, should be improved. The abstract could state the broader relevance of the topic and summarize the results of the case study on LEZs. The introduction should start more directly by introducing the research question and its relevance and describing the new measure and its limitations.

Minor comments: i) what are the summary statistics p10 (car: 36 min, transit: 55 min,...)? I assume they correspond to the mean. ii) I also have identified a few formatting issues (e.g. Fcij p10 and 4.72km2 p 8).

Reviewer #3:

This manuscript extended the authors' previous work spatial availability measure, which is a type of location-based accessibility measure that is both constrained and competitive compared to Hansen-type measure and Shen-type accessibility measure, into a multimodal framework. The new measure, multimodal spatial availability, strengthened the constrained (or finite) nature of opportunities, and the competitive nature among multimodal accessibility resulting from this constraint through a synthetic example and an empirical example of the LEZ in the city of Madrid. In conclusion, the authors demonstrated one restriction had impacted the spatial availability of opportunities for other modes using and proposed potential future uses in policy planning scenarios. In general, the manuscript was logical and well-structured. The research problem was well defined. The data were available and quite supported the conclusion. The statistical analysis performed appropriately. However, there are some issues: Major issues: Please demonstrate whether "car/motor & transit" and "bike & walk" are comparable or whether they are in an actual competitive relationship? For example, if I work 3km from where I live, maybe I will never choose to take a transit, I will always walk or ride. But if I work 20km from where I live, walking or riding to work seems impossible for me, I have to drive or take public transportation. Car/motor and transit can be in competitive relationship and people can choose which one they prefer, but not choose between motor and walk. This issue will also have an impact on the results of the research. Minor issues: 1. As for Fig 2 and Fig 3, please indicate the meaning of the gray color blocks in illustration. 2. Please change the color scheme of fig 2. The red color scheme makes the LEZ centro area boundary, which is also in red, not visible.