March 16, 2022

Enrico Moretti, Editor
Journal of Economic Perspectives

Dear Mr. Moretti,

Enclosed please find my review of Panle Jia Barwick et al "Efficiency and Equity Impacts of Urban Transportation Policies with Equilibrium Sorting" for the *Journal of Economic Perspectives*.

This paper jointly models residential locations and travel mode choices in an equilibrium sorting framework with endogenous congestion. Their model estimated the equilibrium model of residential sorting with endogenous traffic congestion to evaluate the efficiency and equity impacts of urban transportation policies. They proceed to estimate the model by using two unique data sets and constructing over 12 million hypothetical trip-mode combinations of the home-work commute. Although they developed the theoretical model based on past literature (e.g., LeRoy and Sostelie (1983)), it would still have an original contribution to the literature. In my view, the paper's foremost contributions are to (1) explore the role of preference heterogeneity and congestion externalities in mediating the welfare effects of different transportation policies, (2) a large equilibrium residential sorting literature by incorporating endogenous work commuting decisions in residential location choices, (3) address the negative congestion externality. The resulting estimation and impact analysis are also valuable to those fast-growing development countries whose rapid urbanization and poor infrastructure caused severe traffic congestion and harm to economic development.

The major points in my feedback are bolded in the review, but I briefly review them here (in order):

- *More explanation about the welfare impact.* I recommend more discussion about the welfare impact in Figure 1.

- *Information about 'value of time' variable.* This variable is one of the most important pieces in the model. The paper would benefit from an extensive discussion of what this variable is, what it measures, and how it should be interpreted.

- *Discussion about the cost analysis.* Because in China the pecuniary costs of public transportation are very low, the additional discussion of the comparison of time costs between vehicles and subway will be helpful in section 2 to prove vehicles have lower variable costs.

- *Considering the intercity migration into the model.* The model can be enriched by incorporating more data about intercity migration.

- *The slip of the order.* The order of the distance to the CBD should be rich subway commuters, then poor subway commuters, then rich car commuters, then poor car commuters.

- *The data is a little dated*. Since China has changed a lot in the past several years, the analysis based on the data before 2014 may be different from nowadays situation.

- *Introducing the mechanism to make the reduced-form evidence.* I recommend more explanation about the process of how to make the reduced-form evidence.

- *Potential positive spillovers from the agglomeration of firms.* The spillovers of the empirical equilibrium sorting model are being neglected, which is one of the key points in other relevant studies.

- *Additional discussion about the process of suppressing.* It should be added to ensure the data are not noised and biased.

- *Comparison of the estimation based on Chinese data and American data.* On top of just pointing out the difference in the outcomes, the authors could analyze the reasons briefly.

In light of these comments, my recommendation for this paper is Weak Revise & Resubmit. I'm looking forward to reading future drafts and hope to see it published when it is complete.

Sincerely,

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Undergraduate Student

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**Referee Report for "Efficiency and Equity Impacts of Urban Transportation Policies with Equilibrium Sorting"**

*Overview*

In this paper, Panle et al estimated the equilibrium model of residential sorting with endogenous traffic congestion to evaluate the efficiency and equity impacts of urban transportation policies. They open the paper with an introduction about the transportation issue in Beijing, sorting out Beijing's policies to combat congestion, which is the empirical context of this study. They next developed a stylized theoretical model to better understand the channels by which those policies affect travel mode and residential location choices. They proceed to estimate the model constructing the "ease-of-commuting". They follow the estimation with simulations to examine the impacts of transportations policies and compare their consequences.

More generally, the paper evaluates the efficiency and equity impacts of urban transportation policies with equilibrium sorting. Its contributions are several: accounting for preference heterogeneity, incorporating endogenous work commuting decisions in residential location choices, and addressing the negative congestion.

*Critique*

The critique follows the sequence of the paper, with sections bolded and underlined for quick navigation. Major points are bolded. Before launching into the critique, I want to emphasize that this paper is an impressive effort in both structural model and making contributions to the literature, and these comments are meant to be constructive (not destructive)

The exposition in **Section 2** effectively educates the reader about the theoretical framework. This level of detail is necessary and is too often missing from other research. What's more, they use a lot of figures to make the idea clearer. Even so, I believe this section has some opportunities for improvement that deserve mention:

- At the beginning, the authors show a graphical presentation of the welfare effects of congestion pricing and driving restrictions. They also point out that the welfare impact of the driving restriction is ambiguous. However, I think they could improve by explaining it a little more.

- Another problem I'd like to point out is the estimation of the value of time. Since it is a quite abstract conception, we may feel confused and have difficulty understanding how it is computed and varies between the rich and poor. I recommend the authors to give more discussion about that. How do we define the value of time? Which parts could it be decomposed into? What would it look like if we could observe it?

- In the Commuting Technology part discussed in Section 2, the authors state that the personal vehicles have higher fixed costs and lower variable costs relative to the

alternative commuting mode, subway. But we know in China the pecuniary costs of public transportation are unremarkable. Maybe the additional discussion of the comparison of time costs between these two modes will be helpful.

- More discussion about the applicability of Assumption is also warranted. The model is just a closed-city model with intracity but not intercity migration. I know they assume it to simplify the estimation. However, due to the fact that more and more young people in China choose to work in the big city and live in another city nearby where the price of the house is more affordable, especially for those working class in Beijing, this assumption may be too ideal to be practical.

- One slip of the pen: the order of the distance to the CBD should be rich subway commuters, then poor subway commuters, then rich car commuters, then poor car commuters.

**Section 3** introduces the policy background, data description, and the reduced-form evidence. Comments are as follows:

- This paper relies on two main data sets for the analysis: Beijing Household Travel Survey in 2010 and 2014 and housing mortgage data over 2006-2014 with detailed information on household demographics as well as the work address of home buyers. I think the data used is a little dated. In recent years, China has witnessed a lot of changes, especially demonstrating in rapidly increasing price of houses. As a new paper preparing for publication, I suggest trying to update the data and the setting, which will show obvious differences and even reach the opposite conclusion.

- Figure 4 illustrates the housing and household attributes from housing mortgage data. Since we can easily find the distance to work and the monthly household income don't have a significant causal effect, adding the description of the effect of housing price and housing size in the notes below would help readers better understand.

- In Section 3.3, they use reduced-form evidence to examine whether changes in the transportation systems are capitalized into housing prices and the residential sorting in response to these changes is meaningful. I admit they do a great job in designing the reduced-form to confirm several findings and the comparison between raw data and reduced-form is surely obvious. But I think the paper would benefit more by introducing the mechanism to make the reduced-form evidence.

The empirical equilibrium sorting model that incorporates commuting choices into housing decisions presented in **Section 4** is powerful and parsimoniously characterizes the setting described in Section 3. The authors do a nice job of explicitly modeling the determinants of individual commuting choices and residential location decisions. Detailed comments on this section are as follows.

- In Section 4.1, the authors put forward explicitly they do not model firm locations that could be affected by transportation policies in the long term. As a result, the potential positive spillovers from the agglomeration of firms are being neglected, which is regarded as one of the key points in other relevant studies.

- When modeling the housing demand in Section 4.2, the authors denote that they suppress time $t$ to ease exposition for the household utility and suppress subscript member $k$ for the ease of exposition for the choice model of commuting mode. But additional discussion about the process of suppressing should be added to ensure the data are not noised and biased.

- In Section 4.4, the authors discuss the housing market and the market for driving, respectively. I would like to see a little more discussion about how these two markets interact since it is important to understand the market clearing conditions for these two interrelated markets in the model.

**Section 5** exposits the estimation results. The logic of this part's presentation is quite clear, though I still have two suggestions.

- I feel a little confused about the reason that they generate the measure of the housing location choice model separately for male and female. Since the content above didn't talk about the difference between male and female at all, the sorting here seems abrupt and we can't find much significant effect to distinguish. So maybe they can merge the ease of commuting ($EV_{ij}$) of male and female together.

- Another point I'd like to say is that I think is a good idea to compare the different estimated outcomes of elasticities based on Chinese data and American data. Besides just listing the estimates in this paper and the previous literature using American, I think it would be interesting to analyze the reasons briefly and make the paper more complete.

*Contribution*

Overall, Panle Jia Barwick et al do a nice job (1) exploring the role of preference heterogeneity and congestion externalities in mediating the welfare effects of different transportation policies, which is new in the empirical urban literature (2) incorporating endogenous work commuting decisions in residential location choices, making a great contribution to a large equilibrium residential sorting literature and (3) relating to the literature on transportation policies that address the negative congestion externality. Although they draw from what came before, this paper is effectively entirely new. It is a great attempt to evaluate the efficiency and equity impacts of urban transportation policies.

I believe this paper is on its way to being a successful publication.