ECONOMETRICA

PUBLISHED BY THE ECONOMETRIC SOCIETY

An International Society for the Advancement of Economic Theory in Its Relation to Statistics and Mathematics

www.econometricsociety.org/thejournal.html

November 14, 2008

Professor Che-Lin Su
Graduate School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637

Dear Professor Su:

I am writing to you concerning your paper, "Constrained Optimization Approaches to Estimation of Structural Models," Manuscript 7925, that was submitted to *Econometrica*. I have enclosed copies of four referee reports. I have also consulted with other members of the *Econometrica* editorial board in writing this letter.

All of the referees thought that the idea of this paper was interesting. They all thought it would be great to improve the computation of structural estimators and that using Mathematical Programming with Equilibrium Constraints (MPEC) to do this is an innovative idea for econometrics. On this basis, three of the referees recommended that a revision of the paper be invited. I share these views, and so hope you will prepare a revised version for possible publication in *Econometrica*. I think that estimation of structural models is very important and that the approach you describe is exciting.

The referees raised a number of concerns that we invite you to address in the revised version. We would all like different information about how MPEC compares with the existing approaches. Referee 4 makes some excellent and extensive suggestions along these lines. I endorse the suggestion to run a head-to-head comparison with a modern Nested Fixed Point (NFXP) implementation. Also, please provide at least one additional comparison with existing approaches, in the context of estimation of a game. Referee 4 provides one suggestion. Another suggestion is to make a comparison in the Monte Carlo design of Aguirregabiria and Mira (2007). In any case, we ask that you include a head-to-head comparison in computational methods for a game, in addition to the Zurcher one.

We realize that this involves substantial additional work. However, the referees were very clear that more comparisons were needed in order for them to be convinced of the advantages of MPEC. I also have a similar view. I am optimistic about MPEC given what is written but think that more information would be helpful for all.

It would also be good to help the reader understand when MPEC works particularly well relative to NFXP. For example, Dube, Fox, and Su (2008, "Improving the Numerical Performance of BLP Static and Dynamic Discrete Choice Random Coefficients Demand Estimators") do a nice job at this in another example. Also, it would be good to know what problems might come up with MPEC. For instance, could having enough computer memory be a problem with all those constraints? One of the referees suggested that more information about how to actually use the software be provided. I think that would be great for the supplementary material website. In any case, as is *Econometrica* policy, the software instructions used for the computations in the paper will need to be included in a form suitable for replication, to be placed on the supplementary material website.

It would also be nice to have some theoretical results on comparative performance of the algorithms estimators, though this is not a requirement for publication.

Another important issue is multiple equilibria. Most of the recent literature has relied on the assumption that the data are generated by only one equilibrium (even if there are multiple equilibria at the true parameters). If the data were generated by more than one, then the selection mechanism would need to be incorporated in the likelihood in order for maximum likelihood to be consistent. Ignoring that selection mechanism would result in a misspecified likelihood. This problem cannot be sidestepped by changing the algorithm for computing the maximum likelihood estimator. It is inherent in the specification of the likelihood. The referees are clear about this. Indeed, the paper assumes something very much like this on p. 26, where it is assumed that the "same equilibrium is played in each city of a particular type."

Given this concern, and given that the primary focus of this paper is on computation, it seems best to drop the attempt to do something more about multiple equilibria, and just focus on computational methods for models from the established literature, where the assumption that the data corresponds to one equilibrium is maintained.

It would also be good to discuss efficiency issues somewhat and to be more precise about the bootstrap. One question raised by the referees is

whether MPEC is simply a different way to compute the MLE or whether it changes the estimator. It would be good to clarify this, e.g. in the context of the Zurcher model where a referee asks if the estimators are different.

The referees have a number of expositional suggestions that seem quite reasonable. In particular, all the referees think that the paper could be written as a more positive contribution. For example, Referee 3 suggests deleting most of the material in Section 2 and 5.4, which seems good. The other expositional suggestions of the referees seem good also.

We look forward to receiving a revised version of the paper. Please include with the revision separate responses to the coeditor and each of the referees.

We thank you for submitting your work to *Econometrica*.

Best regards,

Whitney Newey

Whitney Newey
Co-Editor

Attachments