Referee's Report on ms #599
"Existence of exact Walrasian equilibria in nonconvex economies"
by A. D'Agata

Classical general equilibrium theory of the 1960's and early 1970's showed how theorems concerning existence of equilibrium are robust to violations of assumptions used in older work, for example nonconvexities in preferences. In exchange economies, for instance, they can be accommodated provided that the number of traders is large (a continuum) and each trader is small relative to the economy, basically assumptions under which the hypotheses of perfect competition hold. The present work is part of a literature that provides interesting variations on this theme. Here, economies with a large but finite population are considered, and it is shown that by perturbing either preferences or endowments just a little, we can find another economy nearby with an exact equilibrium. (The equivalent in the literature is an approximate equilibrium for the unperturbed economy.) The perturbation becomes small as the population gets large. The analogous problem with convex preferences was dealt with years ago.

The proofs appear to be correct, though I have not checked every one in its entirety. The grammar and spelling are a bit funky in places.

The contribution is primarily technical, though it is clear that implications for calculation of equilibrium, for instance in dynamic economies, are interesting. In the literature on smooth economies and computation, one hazard is that although one might calculate prices that come very close to clearing markets, there is no guarantee that there is in fact an equilibrium nearby. Thus, this manuscript provides evidence that although there might not be an equilibrium nearby, there is an equilibrium of a closely related economy nearby. Moreover, one can employ the convexified economy (taking the convex hull) for computational purposes, computing an equilibrium that is known to exist, and use this to infer that there is an equilibrium of the original, nonconvex economy nearby.

Pushing this further, it would be good to know the bounds on the size of the perturbation as a function of the characteristics of the basic nonconvex economy, for example as an explicit function of the number of traders and the "size" of the nonconvexities. This would be useful for computational purposes, the motivation for the exercise. (Just knowing that the result holds asymptotically is not of use to those dealing with computation.) It should be possible to do this by using the expression that is a consequence of Lemma 4, and that appears about 2/3 of the way down p. 14 in the proof of the main theorem.