Referee report for AEJMacro-2019-0142: "Spatial Inefficiencies in Africa's Trade Network"

Summary:

The paper has two parts. The first part conducts an exercise calculating the optimal road transportation infrastructure for African countries, in the spirit of Fajgelbaum and Schaal's recent paper. The model economies are closed, with two goods (urban and rural), and supply and demand distributed exogenously on a set of discrete locations. Trade happens in both goods, and gains arise because each location is perfectly specialized in the production of one good, yet demands both goods. Trade costs depend both on infrastructure quality, and geography. The planner chooses infrastructure optimally to maximize population-weighted welfare, subject to the model equations and a budget constraint (with an exogenous budget size that is the cost of re-creating the existing infrastructure).

In the second part the author calculates, for each node, the ratio of welfare under planner's solution to welfare under the actual infrastructure. The author then regresses this "local infrastructure discrimination index" on colonial infrastructure, ethnic discrimination and favoritism dummies, and foreign aid/transfers, thereby trying to explain the underdevelopment of infrastructure.

Evaluation:

The paper has a somewhat unusual strategy. It first conducts an optimal policy exercise, and then tries to explain why we are not seeing the optimal policies. The second part will, of course, rely on the first part accurately reflecting the key tradeoffs. Alas, this is hard, and this is exactly where the paper is doing poorly.

In the model, the planner's motive for building roads is entirely driven by the desire to connect places with different endowments (chiefly, urban and rural areas -- I did not see any reference to how productivity differences are calibrated). This assumption results in star-shaped optimal networks around urban areas (see Tanzania, Figure III (d)). In reality, of course, roads are often connecting big cities. The actual road network therefore looks very different from the "optimal" one.

The actual road network clearly reflects considerations that are not in the model, for example: (a) in reality, cities specialize as well in different industries and services, therefore inter-city trade through Ricardian/H-O forces lead to welfare improvements; (b) cities operate on a larger scale, therefore Krugman-type forces result in inter-city trade; (c) roads from the interior to the coastal cities are important both for importing foreign varieties and capital, and for exporting agricultural commodities; (d) roads facilitate the reallocation of labor and the provision of public goods (transfers, military).

The ratio of welfare under planner's solution to welfare under the actual infrastructure (\Lambda_i) will therefore not capture the underprovision of infrastructure, but infrastructure at the graph edges where there are flows happening that the model's mechanisms do not account for. That makes all the subsequent regressions of \Lambda very hard to interpret.

Moreover, I find it puzzling that the author does not describe how output in each location, Y_i, is calibrated (or equivalently, labor productivity). I cannot emphasize enough how important it is to get reasonable values for Y_i. After all, we know that productivity differences across space are enormous. Any exercise that does not get Y_i right is bound to get trade flows wrong -- with obvious consequences for the optimal policy exercise.

Some more technical issues:

- The measured travel time between centroids of A and B is likely to be very different than the cumulative measured travel time between each of the centroids between A and B. I would like to see whether, for instance, the author's constructed travel time between the centroids of Pretoria and Cape Town is similar to the travel time that OSM or Google Maps gives for the same distance (and similarly for important connections between large distant cities).
- I don't understand the parameterization of trade costs; why log distance should be divided by the average speed of travelling, and why Fajgelbaum and Schaal's calibration of beta and gamma should be appropriate in the African context. Even in their paper, they try different values for gamma. Similarly for the distance elasticity: the fact that Atkin and Donaldson find different values for Ethiopia and Nigeria may well come from differences in terrain and infrastructure quality. I do not understand why choosing an arithmetic mean of these two values should be appropriate.
- Colonial railroads typically connect the port with areas in the interior (presumably cities, or places with particular endowments). Given that the planner in the model has no incentive to do so, it is not surprising that the regression will tell us that "there is still too much infrastructure" on these connections (I would assume that actual roads today are correlated with historial railways).
- I find it hard to make much out of the other regressions (ethnic favoritism, development aid) -- in particular because I do not think that the LHS variable captures variation across space in the degree to which there should have been more infrastructure development (and that it is universally acknowledged to be the case). The World Bank regressions look pretty feeble. Even conceptually it is not clear that the World Bank is (or should be) maximizing average welfare.
- In a paper as data-intensive as this one, there should really be an appendix describing all the data sources, variable definitions, and variable construction.