

Report on How Tight are Malthusian Constraints?

PAPER SUMMARY

This paper estimates the elasticity of output with respect to land across the world.

The authors develop a simple model to formalize the insight that greater land elasticity is associated with greater responsiveness of output and productivity to positive productivity shocks. Areas which are more responsive to the fixed factor are relatively less sensitive to non-fixed factors (labor, capital). The model demonstrates that β is a relevant parameter for thinking about growth and living standards and that it can be identified using data on productivity A and agricultural labor density (L_{Ai}/X_i). The key equation in the model is:

$$\ln A_i = \beta \ln L_{Ai}/X_i + \Sigma$$

The empirical part of the paper estimates β proxying for A using data on agro-climatic productivity. The estimation relies on province fixed effects which capture technology which is common to a province, and district level controls (such as urbanization and night light intensity). The authors estimate β for different for different geographic regions (relative to a reference region).

The authors reject the null that $\beta = 0$ and show that estimates for β vary considerably for different parts of the world. They find tighter Malthusian constraints for cooler and more temperate regions (higher β).

This has several implications for thinking about long-run economic development. A larger β implies that a positive productivity shock has a larger impact on living standards. Symmetrically, a negative shock would also have a larger negative effect on population and income. In a world of (exogenous) productivity growth this suggests that more temperate regions, with larger β will benefit more in terms of population and income per capita.

ASSESSMENT

This is a very well done and potentially important study of how geography can shape economic development both in the past and today. The model and data analysis strike me as comprehensive. The authors have considered many of the natural robustness checks and extensions (different functional forms, Malthusian responses, alternative population data etc). They have also made all their data and dofiles available which is commendable. As such, my main comments concern interpretation and motivation.

MAJOR COMMENTS

1. *Insights & Contribution.* First, a minor point. The paper's title "How Tight are Malthusian Constraints?" leads one to believe that fertility responses will be part of the analysis (which they are not; they are considered in

the appendix). Second, the motivation for the paper is caught between a historical development style-motivation and a modern growth economics motivation. I think the authors need to sharpen their contribution to this literature in the opening paragraphs.

My suggestion is that the authors rewrite their introduction in a way that gives the reader a better flavor of their main findings. For example, the authors could begin by noting that the idea that geography matters for economic development goes back at least as far Montesquieu as does the idea that temperate and tropical regions face fundamentally different economic constraints. This paper operationalizes this intuition by introducing a measure of land elasticity.

2. *Trade*. One simple intuition I had does not appear to be directly addressed in the paper. This concerns trade. It seems that in a world of frictionless trade, we would not expect the land elasticity to matter at all? Therefore the relevance of the land elasticity seems to hinge on the existence of trade frictions. Why is this intuition incorrect? (The authors do deal with the opposite assumption—that districts are autarkic—in the appendix).

Similarly, can the authors discuss the implications for standard models of growth of assuming a constant β ?

3. *Urbanization*. Related to the above point, the authors claim that “While our work uses the geographic distribution of rural population to estimate Malthusian land constraints, it has no implications for the spatial distribution of urban activity”. But in a Malthusian or semi-Malthusian setting, we normally think about city size as related to the size of the local agricultural surplus. So this seems wrong, at least for poor countries or for the preindustrial era? Preferably the authors should carefully how their model of structural change relates to models of urbanization and economic growth.
4. *Historical or Contemporary Development?* The authors want this paper to be about both (p 1). This creates several infelicities in exposition i.e. on page 13 where the authors have to write “Despite our focus on Malthusian constraints, using modern population data can still be informative, and is the reason we derived an explicit expression for agricultural, rather than total, population density”. I think the authors can avoid this awkward exposition.

I appreciate that sufficiently high resolution data may not be available for the authors to replicate their main estimates for the premodern period.¹ Nevertheless, in terms of exposition, the paper would read better if the authors began by motivating their interest in land elasticity in terms of a Malthusian model that is most relevant for the preindustrial era. They could

¹If data availability was not an issue, ideally the authors would estimate an land elasticity for the Malthusian era, and then show how this land elasticity continues to matter for modern data.

present some motivational results (scatterplot or maps) in the introduction to fix ideas for the reader. This could then lead to their more rigorous results using the HYDE data from 2000 (where they have high resolution data). I think this would help convey the relevance of their findings for both historical and contemporary development in a much more persuasive way. The authors could use their 1900 and 1950 HYDE results for these purposes too (currently it is in the appendix).²

5. *Visualizations.* I was extremely surprised to see no maps for the paper (at least in the appendix). I appreciate that mapping software like ArcGIS is buggy, but the authors really need some maps to help visualize the data. Specifically, I would like to see various maps of the underlying data for the entire world. Then to really understand the variation that is used to identify β the authors should provide high definition maps of a specific region (say China) to see how much variation there is within a large county or a region. Visualizations will not just make the paper more accessible but will enhance the credibility of the empirical work.
6. *Historical Implications?* Section 4.2 is a minor part of the paper. Nevertheless, the author's speculations on the impact of the Black Death in Europe in comparison to disease epidemics in other parts of the world probably need to be either fleshed out or removed. For example, to be credible the authors would have to explain why earlier outbreaks of plague (such as the Antonine plague or Justinian's plague) did not have a similar effect to the Black Death (suggesting that time-varying factors such as institutions were crucial in explaining the impact of the Black Death in Europe rather than β).

The implications for Asian involution are likewise interesting and potentially important. I think the paper would be stronger if it brought out this implications more forcefully in a more substantial and developed discussion section.

MINOR COMMENTS

1. Is the term "Political Regions" the most accurate one here? It suggests that the authors are interested in political institutions (which they are not).
2. Japan and Korea have low values of β for temperate regions. The authors note that "neither Japan nor the Koreas fall into equatorial zones with hot summer months". But anyone who has visited either country in July will strongly disagree with at least the latter part of that statement.

²Additionally, I was under the impression that the HYDE data went back much further than 1900?

3. The discussion of the land share on 22 seems to suffer from a confusion between modern estimates of the land share and historical estimates (which are larger). Can the authors clarify this discussion?
4. Conley Standard errors. My sense is that a 500 km window is fairly large. Can the authors explain why they didn't consider smaller windows?