

## Referee Report

# Uncertainty and Capacity Constraints: Reconsidering the Aggregate Production Function

### **General Remark**

The author addresses the economically relevant question on the properties of the aggregate short-run production technology. Clearly, this has an impact on short-run adjustments to shocks, hence the business cycle dynamics. The analysis is carefully done and **I recommend conditional acceptance for publication**. I will be more precise below.

The paper is well structured in two main parts: a theoretical deviation of the aggregate short-run production technology and an empirical test. In my referee report, I will focus on the theoretical part.

### **Notes on the Introduction**

The introduction provides a lengthy discussion of the Cambridge discourse. From the perspective of history of economic science, this is probably interesting but it is much too long as a motivation for a technical paper. In particular, it takes too many pages until the author formulates the research question and gives a preview on the results – this should actually be done in the first paragraph. Despite the lengthy discussion of the very old literature, the author misses to include newer approaches that are directly linked to the sunk cost argument: the literature on irreversible investment by Dixit (1995), Bertola

(1998), Holt (2007), etc.

Furthermore, the discussion is too imprecise and loose which often leaves wrong impressions: e.g. the author refers to the Cobb Douglas as 'the' neoclassical production function. However, the neoclassical production function is completely characterized by constant returns to scale, positive but diminishing returns, and the Inada conditions.

Finally, the style of using brackets too extensively here but also in later chapters as well, makes the paper indeed hard to read.

### **Notes on the Theoretical Derivation**

The graphical introduction to the theory part is excellent and really helps the reader to understand to rational behind the non-concavity of the technology.

The mathematical derivation however uses a quite unusual and confusing notation. E.g. in order to describe the production technology mathematically, it would be more convenient to define the non-exclusive input factor and output sets  $\mathbf{x} = \{x_1, x_2, \dots, x_n\}$  and  $\mathbf{Y} = \{y_1, y_2, \dots, y_m\}$  and the production technology is nothing else than a mapping from one set into the other,  $f_{it} : \mathbf{X} \rightarrow \mathbf{Y}$ , where  $i$  denotes the  $i$ 'th technology at time  $t$ . Furthermore, it seems that the author excuses himself from using continuous time notation and ends up in discussing the pros and cons of continuous and discrete time extensively. We all know that and it is unnecessary for the paper. just argue shortly that the use of continuous time has technical advantages. The mathematical derivation is complete and carefully done. However, I recommend to use a more structured approach using propositions and proofs in order to shift parts of the math to the appendix.

The paper also nests the Cobb-Douglas function in the new framework, which is well done and facilitates the understanding enormously.

## Recommendations

I recommend condition acceptance for publication. The paper is carefully done but the exposition needs to be improved. I recommend to work on three points explicitly before publishing the paper:

1. shorten the introduction substantially; get rid of the history of economic science approach; the purpose of the paper, the research question and the preview of the results should occur latest in the second paragraph of the introduction; focus more on recent literature than on the old Cambridge discourse in the literature review
2. more structured approach for the exposition of the mathematical part: use environments (as they are for example provided by latex) to structure assumptions, propositions, proofs, corollaries, etc. and use appendices to get rid of too lengthy derivations in the main text; moreover, get rid of the lengthy discussion of continuous and discrete time
3. use mathematical more appropriate notation that makes it easier for the reader to access the paper

## References

- Bertola, G. 1998: Irreversible Investment, in: *Research in Economics*, Vol. 52, pp.3-37.
- Dixit, A. 1995: Irreversible Investment With Uncertainty and Scale Economies, in: *Journal of Economic Dynamics and Control*, Vol. 19 (1-2), pp. 327-350.
- Holt, R. 2007: Investment, Irreversibility and Financial Imperfections: the Rush to Invest and the Option to Wait, in: *Economics Bulletin*, Vol. 5(10), pp. 1-10.