Referee report

Uncertainty and Capacity Constraints: Reconsidering the Aggregate Production Function

General Remarks

This paper addresses the question whether the Cobb Douglas production function is best suited for the replication and analysis of short-run economic fluctuation. The author argues that the properties and the theoretical foundation of the Cobb Douglas production function are rather weak and unsatisfactory. He then elaborates on an alternative aggregate production function. After a theoretical derivation, the alternative production function is empirically tested and compared to the properties of the Cobb Douglas production function.

Introduction

The introduction provides a lengthy discussion of the history of the development, application and critique of the Cobb Douglas production function. For the purpose of the paper, the introduction is much too long. It should be extremely streamlined and more focused on the subsequent research question. Furthermore, the author refers to the Cobb Douglas production function as 'the' neoclassical production function. However, the neoclassical production function is completely defined by positive, but diminishing returns to individual factors, and constant returns to scale. The author states that almost all DSGE models contain a Cobb Douglas production function. However, this does not seem correct, as often CES production functions in general are used.

Empirical analysis

The author intents to replicate *short-run* fluctuations of US real GDP. Hence, he estimates both the Cobb Douglas production function and the alternative production function in first differences. However, the neoclassical production function was developed with the intention to analyse *long-run* GDP growth. The author argues that in the short run, only labour input is a variable factor. Hence the capital stock should not be included in the estimation of the production function. However, as already argued above, the neoclassical growth model has been designed for long-run, not for short-run analyses. In the long run, capital *is* indeed variable and should therefore be included in the production function.

Usually in macroeconometric models the Cobb Douglas production function is estimated in levels rather than in first differences. When estimated in levels, the Cobb Douglas production function usually provides reasonable results, which are much better than the empirical results found by the author. Alternatively, the Cobb Douglas production function might be estimated in its intensive form, i.e. with GDP per worker or per hour, respectively, as the dependent variable and the capital intensity, together with a constant capturing technical progress, as the explanatory variables.

Recommendation

I recommend acceptance of the paper for publication, conditional on revisions. The following points should be addressed:

1. The introduction should be streamlined and considerably shortened. Instead of a lengthy debate of the historical development of the Cobb Douglas production function, the author should come much more quickly to the point of his research agenda and on the outline of the paper.
2. In the theoretical part of the paper, the mathematical derivations are clearly too extensive. Substantial parts of the mathematics should be moved to the appendix.
3. The author develops his alternative production function for a closed economy and argues that large economies like the US may be treated as closed ones. However, the Cobb Douglas production function does not rest on this restrictive assumption, but is rather suited for open as well as for closed economies.

4. Both in the theoretical part and in the empirical estimations, it should be made much clearer why the author uses the production function to replicate short-run output fluctuations, although originally the neoclassical production function was developed for long-term growth analyses.
5. In the empirical estimations, it is not quite clear why the interest rate (the Federal Reserve Prime Rate) is corrected by the growth rate of M2.
6. When estimating the Cobb Douglas and the alternative production functions, the author should try to estimate the production functions in levels (which would, by the way, correspond to the original intention of the neoclassical model to explain long-run growth). In such an exercise, the Cobb Douglas production function will certainly deliver reasonable results, rendering the argument for developing an alternative production function obsolete.