

Review: *Economics E-Journal*

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Title: *Factors affecting the efficiency of the BRICSS' national innovation systems: A comparative study based on DEA and panel data analysis*

Comments

When putting the study into context, it is outlined that there are three different ways known from the literature to investigate the capacity of a NIS (→ see p. 5). In fact, there are three, but the author looks at them from a too narrow angle. All three correspond to the literature on productivity measurement, namely (1) (Productivity) Indices, (2) (common) Production Functions (OLS, etc.), and (3) Production Frontier Functions (i.e. estimation of the efficient boundary of the production possibility set and relating any observation accordingly, with attributing any distance to the frontier to in-efficiencies). There is ample literature on strengths and limitations of each of the approaches. See for instance:

- Harold O. Fried, C. A. Knox Lovell, Shelton S. Schmidt (1993): The measurement of productive efficiency
- Kumbhakar and Lovell (2000): Stochastic Frontier Analysis
- Coelli, Rao, O'Donnell, Battese (2005; 2nd edition): An introduction to Efficiency and Productivity Analysis

The author misses to discuss these strengths and limitations of the mentioned approaches in the light of the envisaged analysis. In particular, the applied approach of a two-stage calculation of efficiency (DEA first stage + regression of efficiency scores in a second stage) is discussed controversially in the literature. Actually, it is sometimes even called schizophrenic as it implicitly assumes that there are no influence factors in the first stage - otherwise they would need to be taken into account in order to calculate un-biased efficiency scores - and then, in a second stage, regressing the results of the first stage exactly against these influence factors. One may well argue that specifying the efficiency scores in the first stage without taking relevant environmental variables into account must lead to biased efficiency results (in other words: the distance of a certain DMU to the frontier is not due to in-efficiency but due to a certain combination of environmental factors). However, the author decides to estimate efficiency of NIS by applying DEA without reflecting these issues.

Moreover, the author does not question what empirically observed in-efficiency in the context of any country's NIS really means. Some theoretical considerations would be needed in this regard. In fact, given the very nature of a DEA, any additional dimension in terms of input or output could lead to drastically changing efficiency scores of a certain DMU (given a DMU prior considered as fully efficient; TE can only decrease). Hence, in-/excluding crucial inputs or outputs relevant for the NIS from the analysis is non-trivial, but not discussed sufficiently by the author.

To the same token, in chapter 3.1 a number of potential impact factors are mentioned. But when it comes to defining what is to be taken into account for the DEA many of these points remain disregarded. There is ample room for discussion in this regard. See literature!

AND: I was wondering to read at page 18 that "based on all the regression results in Table 5, 7 and 8 it is clear now how the NIS efficiency is affected by relevant influencing factors...". In fact, what this regression analysis may contribute to the scientific debate (if anything at all) is empirical evidence concerning the relevance of some environmental conditions as potential determinants of efficiency, but certainly no rational / no explanation about the causality behind. It would be the job of the author to present a theory / conclusive hypotheses to be tested empirically / theoretically! Unfortunately, this is missing. Hence, the contribution remains to be a presentation of some empirical evidence only with limited value added to the scientific discourse seeking a more coherent understanding of NIS.

Finally, one may argue that a NIS is not a production unit in the sense of transferring inputs into output (as implicitly assumed in the given analysis → Decision Making Unit...). Actually, NIS is rather a concept meant to explain what is relevant in terms of innovativeness within a given territory and how these determinants might be linked. The capacity or - even better - the performance of any NIS presumably might be better approximated by looking at changes in TFP (of the economy / sector / region), i.e. the outcome of the innovation process rather than the number of filed patents and published scientific papers, etc.

Further, more specific comments:

- For the DEA Constant Returns to Scale are assumed. Discuss implications!
- Changes of efficiency scores from one year to another can be significant (due to the nature of DEA methodology of comparing only two points in time for calculating a certain TE score rather than estimating a TE trend function). Moreover, there is no statistical noise controlling / capturing external shocks... This is sensitive! Discuss how to deal with this before entering into the regression analysis of the efficiency scores!
- SE and NL seem to be frontier setters over the entire analytical period. Discuss how this can be (given that, for instance, FR, DE and FI achieve in the same periods only efficiency scores around 0.5)! These issues are mentioned at page 9, but no rationale is given why this could be so. However, before entering into a second stage regression analysis one should have an understanding why the calculated efficiency appeared to be empirically so different (in particular for technologically rather similar countries).
- I'm not convinced that "endowments of natural resources ... have a negative impact on the efficiency of NIS..."; as stated in p. 10. And if so, please explain the rational / theoretical link behind. Causality is the issue here. The argumentations in page 10, last paragraphs of chapter 2.3, are not conclusive at all.
- Proxy variables: Outline in brief what is envisaged to control for / captured by a certain proxy and what causal link to efficiency is assumed correspondingly.

Formalities

Throughout language check is needed!