

Economics

Manuscript Ref.: Economics-647-1

Title: “Analyses on the Efficiency of National Innovation System for the BRICS and the Influencing Factors: A Comparative Study based on DEA and Panel Data Analysis”

Comments and suggestions for author of manuscript No. Economics-647-1

Summary:

This paper investigates the efficiency of 22 National Innovation System (NIS) during the period 2000-2008 using data envelopment analysis (DEA).

In a second stage, taking efficiency scores as the explained variable and applying panel data regression model, the paper is intended to shed light on factors affecting NIS efficiency. To examine the robustness of the regression results, various model specifications - with time and individual effects, weighted regressions - are used to test the effect of relevant factors on the relative efficiency of NIS for 22 countries.

The authors find that the BRICS countries are very different in their relative efficiency of NIS. Furthermore, the influential factors for NIS efficiency are very different among countries, although ICT infrastructure, scale factors and openness turn to be very relevant.

General Comments:

The paper is an interesting attempt to investigate the influencing factors of NIS countries' performance.

While the question is interesting, the choice of methodology is not always appropriate, its implementation is confusing and many empirical problems have not been addressed. I cannot recommend this paper to be published in its current form.

Detailed Comments:

- To estimate efficiency scores the authors use DEA by assuming Constant Return to Scale without testing it. Returns to scale characterize properties of the attainable set and its frontier. The returns to scale is an important issue to better evaluate the role of the size on the production process; Simar and Wilson (2002) suggest a non-parametric test of returns to scale that should be implemented in this context.
- Although the DEA method is deterministic, the efficiency scores are computed relatively to estimated and not true frontier and, therefore, they are subject to sampling variation of the estimated frontier (Simar and Wilson, 1998). To obtain bias-corrected efficiency estimates I would suggest to use the bootstrap based on bias-correction procedure suggested by Simar and Wilson (1998).
- The authors perform a unit root test to avoid a spurious regression. However consistency of this test requires sufficiently large N and T. With only 8 time periods the test is not consistent and the inference is invalid.
- The authors use principal factors analysis to eliminate the multi-collinearity which is assumed and not tested. A test of multicollinearity should be performed before proceeding with principal component analysis.

- Overall, the most problematic point is that the authors based their analysis of the relationship between various factors and NIS performance on a two-stage approach, where efficiency is estimated in the first stage and then the estimated efficiencies are regressed on covariances. Simar and Wilson (2007) underline that in the two-stage approach the standard inference is invalid due to unknown serial correlation among the estimated efficiencies.

What about using single or - even more efficient - double bootstrap procedure proposed by Simar and Wilson (2007) to obtain valid inference?

Ratings: Quality of Content - Poor

Quality of Presentation (Clarity, Succinctness, Aptness) - Poor

Recommendations: - Reject/Major Revision

References

Simar, L. and Wilson, P. W.: 1998, Sensitivity analysis of efficiency scores: How to bootstrap in nonparametric frontier models, *Management Science* **44**, 49–61.

Simar, L. and Wilson, P. W.: 2002, Non-parametric tests of returns to scale, *European Journal of Operational Research* **139**, 115–132.

Simar, L. and Wilson, P. W.: 2007, Estimation and inference in two-stage, semi-parametric models of production processes, *Journal of Econometrics* **136**, 31–64.