

Efficiency analysis of a multisectoral economic system

Topic: Analyzing productivity

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“Recessions are easily recognizable from a decrease in GDP. What really should interest us, however, is the difference between the potential of an economy and its actual performance” said Stiglitz in 2002. In the literature two approaches of productivity and efficiency analysis can be found, namely neoclassical approach and a frontier approach know as data envelopment analysis (DEA). Under neoclassical approach we refer to the seminal paper by DEBREU (1951), measuring the efficiency of the economy by a coefficient of resource utilization and to the books by ten RAA (1995) and (2005). DEA approach allows to decompose productivity growth into a movement of the economy towards the frontier and a shift of the latter. Neoclassical approach imputes productivity growth to factors, but cannot distinguish a movement towards the frontier and a movement of the frontier. In the paper by ten RAA-MOHNEN (2002) a synthesis of both approaches is provided.

The problem addressed in the present paper is concerned with efficiency analysis applied to a single economy represented by the Leontief input-output-model extended by the constraints for primary factors. First, the efficiency frontier is generated using a multi-objective optimization model instead of having to use data from different decision making units. The solutions of the multi-objective optimization problems define efficient virtual DMUs and the efficiency of the given economy is defined as the difference between the potential of an economy and its actual performance and can be obtained as a solution of a DEA model. It can be shown that the solution of the above defined DEA model yields the same efficiency score and the same shadow prices as the models by ten RAA (1995), (2005), despite the different variables used in both models. Using duality theory of linear programming the equivalence of the approaches permits a clear economic interpretation.

In the second part of the paper this approach is extended to the Leontief augmented model including emissions of pollutants and abatement activities. In this way the eco-efficiency of an economy can be analyzed.

References:

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