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Production analysis in environmental, resource, and infrastructure evaluation

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Abstract

Over the past several decades, significant efforts have been made to regulate the use of resource and pollution in most industrialized countries, and the stringency of pollution regulations has continued to increase globally. At the same time, physical and social infrastructures are influenced by changes in the use of resources which contribute to the wealth of many regions. Technical progress plays an important role in maintaining a high standard of living in the face of these increasingly stringent regulations. This thematic series looks at how recent advances in this field to contribute to understanding the evaluation for environment, resource, and infrastructure management.

JEL classification: O10; O13; O18; Q01; Q40; Q50

1 Introduction

Over the past several decades, significant efforts have been made to regulate the use of resources and pollution in most industrialized countries, and the stringency of pollution regulations has continued to increase globally (see example on climate change on Somanathan et al. (2014)). At the same time, physical and social infrastructures are influenced by changes in the use of resources which contribute to the wealth of many regions. Technical progress plays an important role in maintaining a high standard of living in the face of these increasingly stringent regulations (Managi 2011).

Several techniques are able to assess the importance of technical change or productivity change considering environmental or resource performance. Deterministic frontier analysis of data envelopment analysis, or stochastic frontier analysis, in addition to the conventional production function approach is useful tools in this objective (Barros et al. 2013; Managi et al. 2004; Kumar et al. 2015). Furthermore, these techniques are suggested to apply to the evaluation of infrastructure management (Managi 2015a,b). This thematic series looks at how recent advances in this field contribute to understanding the evaluation for environment, resource, and infrastructure management.

2 Results

We solicit papers concerning theory and application into diverse regions and focus. First paper tackles renewable policy planning using long-range energy alternatives

planning system (LEAP). Halkos et al. (2015a) utilize the system for forecasting and analyze four long-term renewable energy scenarios for the Greek sectors. They evaluate the efficiency of renewable energy commitments on decreasing greenhouse gas (GHG) emissions. The results find that the efficiency of renewable energy commitments set under the law would not be sufficient to decrease systematically the generated GHG emissions. For the government to have more effective emission reduction, it needs to increase the share of energy consumption produced from renewable resources at least up to 27 % by 2020.

International trade has significant impact on the environment (Managi 2011). Honma (2015) analyzes the impact of international trade on environmental efficiency including carbon dioxide (CO_2) emissions. He measures the environmental efficiency of four emissions and finds that trade openness is positively correlated to the environmental efficiency. The study shows that the higher the relative income per capita, the more the benefit of trade on the environmental efficiency.

Infrastructure requires evaluation *ex ante* and *ex post*. Commonly, when the decision to what and when to construct is not prepared well, it does not necessarily mean that performance of infrastructure construction is good. However, if it is immediately required, it might be good such as when large damage right after the natural disaster occurred. Halkos et al. (2015b) examine the effect of man-made and natural disaster occurrences on countries' production efficiency levels. Their empirical findings suggest that the relationship is nonlinear forming an inverted U shape regardless of the countries' income classification. This implies that a lower number of disaster occurrences has a positive influence on countries' productivity improvement due to possible stimulation of restructuring and investment policies imposed by governments as counteractions of those events. After a certain threshold level, the effect becomes negative, influencing countries' production factors.

The wage increases and labor productivity is a common topic that needs to be discussed for cost-competitiveness of industries and countries. Mizobuchi (2015) proposes an alternative decomposition of the change in unit labor cost (ULC) with a measure of a comprehensive wage effect. This fully captures its direct as well as indirect impact. He finds the wage effect to be significantly overestimated under the conventional decomposition.

As more data are available to emerging countries such as China, application study increases over time. Cao et al. (2015) take further step to comprehensively grasp not just environmental pollution but including human health in China. They focus on regional differences in productive inefficiencies and attempts to clarify the determinants of inefficiency, accounting economic, environmental, and health-related factors. After accounting for environmental pollution and health impacts, they find the productive inefficiency reduced.

Another country where emission data such as CO_2 emissions are available and require particular attention is an emerging country such as Indonesia. Armundito and Kaneko (2015) provide empirical evidence of changes in the productivities of manufacturing firms in Indonesia over time of total factor productivity (TFP) with and without considering CO_2 emissions. They show that TFP with CO_2 emissions has grown faster than TFP without CO_2 emissions.

3 Discussions

Apart from this special issue, performance analysis now became a common practice not just in academics. Techniques introduced in this special issue are also used in practice such as checking regulatory changes in law and performance improvement, evaluating potential improvements of revenue increase and emission reduction, or resource-saving by catching up with the frontier firm, measuring technological production frontier shift in firm, industry, or country.

In the field of technical aspects, there are still many areas that needed to be developed. Chen et al. (2015) explore approach in the context of environmental policy evaluations, and Kerstens and Managi (2012) show the importance of differentiating convex and non-convex treatment in production function. Wide ranges of applications are also provided empirically using global (Fujii and Managi 2015) or developing country (Fujii et al. 2015). In terms of data disaggregation, firm level or field level analysis started increasing globally in resource and environmental economics field (Managi et al. 2005; Yagi et al. 2015). Formally, lack of disaggregated data such as firm level data makes traditional (aggregated) country level or industry level analysis applied. Future research and practice need to take these developments into account for evaluation.

Competing interests
Both authors declare that they have no competing interests.

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