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Productivity growth in OECD countries: A comparison with Malmquist indices

Barış K. Yörük [a,*], Osman Zaim [b]

[a] *Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA 02467-3806, USA*
[b] *Bilkent University, 06800 Bilkent/Ankara, Turkey*

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We utilize two alternative indices to measure productivity growth for all but two OECD countries. First, we employ a Malmquist productivity index without considering the existence of hazardous by-products of production processes. To address the shortfalls of this index, we construct an alternative Malmquist–Luenberger productivity index and find that the Malmquist index underestimates the productivity growth. Finally, we investigate the effects of an international protocol on reducing global emissions and country-specific effects on Malmquist–Luenberger productivity measures. *Journal of Comparative Economics* **33** (2) (2005) 401–420. Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA 02467-3806, USA; Bilkent University, 06800 Bilkent/Ankara, Turkey.

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* Corresponding author.
E-mail addresses: yoruk@bc.edu (B.K. Yörük), zaim@bilkent.edu.tr (O. Zaim).

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1. Introduction

Increased awareness of environmental quality has prompted policymakers to adopt precise measures of the environmental impacts of policy choices and consider these when formulating economic policy. As environmental issues are becoming more important and treated as international matters, countries are required to measure, document, and publish accurate information on their impact on a set of economic indicators ranging from national accounts to social indicators. As an initial step, an assessment that internalizes negative externalities in production processes is essential. However, traditional measures of productivity growth, e.g., Törnquist and Fischer indices, concentrate only on the production of desirable outputs and fail to consider environmentally hazardous by-products of production processes. Hence, this approach yields biased measures of productivity growth.

To measure productivity growth that accounts for undesirable outputs, one possible approach is to modify traditional indices so as to incorporate negative externalities. However, this methodology requires price information for both desirable and undesirable outputs as well as inputs. In this case, shadow prices for each of various inputs, outputs, and pollutants can be computed by the methods found in Pittman (1983) and Färe et al. (1993). Alternatively, Färe et al. (1989, 1994a) propose a tool to measure productivity that requires information on quantities only. Their non-parametric Malmquist measure relies on constructing a best practice frontier over the whole sample and computing the distance of individual observations from the frontier. This Malmquist index,[1] hereafter referred to as the M index, can be partitioned exhaustively into useful component measures. In particular, it can be decomposed into technical change and efficiency change components. However, the M index must be modified to incorporate negative externalities if environmental issues are to be considered.

In their seminal work, Chung et al. (1997) propose a modified version of the M index to measure productivity growth in the presence of the joint production of both desirable and undesirable outputs, namely the Malmquist–Luenberger productivity index; hereafter referred to as the ML index. This index considers the reduction of undesirable outputs as well as the increase in desirable outputs; it also possesses all the desirable properties of the M index. In contrast to the extensive literature on the M index, only a limited number of empirical studies employ the ML index to measure productivity growth. Using micro-level panel data, Färe et al. (2001) employ the ML index to account for both marketed output and the output of pollution abatement activities of US state manufacturing sectors from 1974 to 1986. Weber and Domazlicky (2001) apply the same methodology to state manufacturing data and the aggregated emissions from the US Environmental Protection Agency's Toxic Release Inventory from 1988 to 1994.

As industrial activity reaches as levels that lead to irreversible environmental damage, governments and international bodies try to enforce regulations to control the resulting pollution. Policies that improve environmental management not only slow the rate of natural resource depletion, but also advance sustainable growth. These standard-setting approaches are referred to as the precautionary principle in Article 3 of United Nations Framework

[1] The survey chapter in Färe et al. (1998) is an extensive source of references to the literature on the Malmquist productivity indices.