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# Robust Measurement of National Technological Progress

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## Abstract

We propose a measure of technological progress based on the information embedded in standard input-output tables. A connection is established between the quantities necessary as inputs, the associated output and auxiliary prices. It is argued that the *wage-profit frontiers* and the associated production prices together provide a robust basis for measuring technological progress and productivities. The computation of the *wage-profit frontiers* is a non-trivial exercise because of high combinatorial complexity. An algorithm that renders this computation feasible is presented. We analyze technological progress and productivities among 30 countries between 1995-2011 using the latest multi-regional input-output data.

*Keywords:* Technological Change, Input–Output analysis, Wage Profit Frontier, Productivity

## 1. Introduction

In this paper we propose a measure of technological progress of a region or nation based on the information embedded in its standard input–output tables by computing the *wage-profit curves*, and the *wage-profit frontier*. Our aim is to measure the technical efficiency of the economic system, but we depart from the conventional practice of estimating a surrogate *physical* aggregate production function<sup>1</sup>. Instead, we resort to computing the *wage-profit frontier*<sup>2</sup>.

We do not aggregate quantities that have conceptually different physical units. We do not follow methods that require the computation of an aggregate production function as proposed by Farrell (1957). He proposed a way to measure productive

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<sup>1</sup>For an investigation on the aggregate production function and its neoclassical properties see the companion paper Zambelli (2017).

<sup>2</sup>Throughout this paper, we have used the term *wage-profit frontier* consistently for reasons of clarity, even though one find other terms by which it is referred to in the literature, such as: *factor price frontier*, as in Samuelson (1962, p.195), Hicks (1965, p.140), Diamond (1965, p.1134), or *optimal transformation frontier* (Bruno, 1969, p.39). Though different terms have been used, they are all concerned with the *choice of efficient techniques* (Robinson, 1953; Pasinetti, 1966; Garegnani, 1966; Bruno, 1969; Sato, 1974; Pasinetti, 1977).

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