

# Capital accumulation and TFP growth in the EU: A production frontier approach

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## Abstract

The aim of this article is to analyse labour productivity growth and convergence in the EU between 1980 and 1997. By adopting a production frontier approach, labour productivity growth is broken down into components attributable to efficiency change, technological progress and capital accumulation. Our results point to physical and human capital accumulation as the main factors driving the processes of labour productivity growth and convergence among the European economies, supporting the European cohesion and development policies carried out in these years. On the other hand, we observe that some problems appear in the EU in terms of total factor productivity (TFP) growth. Therefore, policies aimed at promoting TFP growth should also be strongly supported.

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## 1. Introduction

The EU Treaty recognises the existence of significant income disparities among the European economies and defines economic and social cohesion as one of the main objectives of the EU. European development and cohesion policies have received greater attention since the beginning

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of the 1980s and, according to the European Commission, they have positively contributed to economic growth and income convergence in the EU.<sup>1</sup> These benefits are not only in the form of co-financing programmes in the fields of physical infrastructure and education and training – as well as giving support for the private sector – but also through an institutional framework which helps to enhance the efficiency of public spending by reinforcing programming, evaluation, monitoring and financial control. However, structural policies in Europe have often been criticised arguing that they mainly serve redistribution purposes, but have little effects in fostering economic growth and convergence at the EU level.<sup>2</sup> Thus, the debate concerning the capacity of European policies to reduce income disparities remains open.

The present study tries to yield new insights into the processes of productivity growth and convergence experienced by the European economies over the last two decades, a period of time that shows an important increase in public resources devoted to favouring these processes. Special attention is paid to physical infrastructures and human capital endowments since development and cohesion policies in the EU strongly support investments on both variables. Moreover, the frontier approach followed in this study allows avoiding the possible bias derived from the assumption that all economic units operate efficiently, which is a common assumption in the standard literature on economic growth. The standard approach typically starts from an aggregate production function in which the total output depends on the productive inputs and the current level of technology, being the growth rate determined by the accumulation of the productive factors and the rate of technological progress. Assuming that all units of production operate efficiently, traditional growth-accounting exercises decompose economic growth into contributions due to factor accumulation and total factor productivity (TFP) growth, which is identified with technological progress.<sup>3</sup> On the other hand, studies in the tradition of a production frontier approach consider the possible existence of inefficiencies (being inefficient behaviour measured by the difference between the actual level of production and the maximum possible level defined by the frontier). This in turn allows decomposing TFP growth into efficiency change, represented by movements of the economy towards or away from the frontier, and technological progress, represented by shifts of the production frontier.<sup>4</sup>

Some recent studies have focused on the decomposition of TFP growth into efficiency change and technological progress, analysing their contribution to economic growth and, to a lesser extent, to economic convergence.<sup>5</sup> In the context of this literature, the aim of this article is to analyse labour productivity growth and convergence in the EU-15 countries during the period 1980–1997 by adopting a production frontier approach. Under this approach, labour productivity growth is broken down into components attributable to efficiency change, technological progress and capital accumulation. Non-parametric techniques of linear programming (Data Envelopment Analysis) are used to estimate a common production frontier and TFP is decomposed by means of Malmquist productivity indices. With regard to capital accumulation, we analyse the contribution of private

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<sup>1</sup> See the different Cohesion Reports of the European Commission (1997, 2001 and 2004). For a good survey of the models used to evaluate the macroeconomic impact of EU cohesion policies, see Ederveen, Gorter, Mooij, and Nahuis (2002).

<sup>2</sup> For a criticism on structural policies in Europe see, for example, Boldrin and Canova (2001).

<sup>3</sup> Under this approach TFP is calculated residually and it is often referred as the “Solow residual”.

<sup>4</sup> Raa and Mohnen (2002) offer a theoretical framework that encompasses both the neoclassical growth-accounting and the frontier approaches.

<sup>5</sup> From an international perspective, see, for example, the works by Färe, Grosskopf, Norris, and Zhang (1994), Henderson and Russell (2005), Kumar and Russell (2002), Maudos, Pastor, and Serrano (1999), Perelman (1995) or Taskin and Zaim (1997).

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