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The ‘appropriate technology’ explanation of productivity growth differentials: An empirical approach[☆]

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Abstract

This paper aims at giving empirical content to the Basu and Weil (1998) [Basu, S., Weil, D.N., 1998. Appropriate technology and growth. *Quarterly Journal of Economics* 113, 1025–1054] theory of growth, in which localized innovation, assimilation of spillovers and differences in speeds of capital intensification yield diverse patterns of international convergence and divergence. The contributions of these sources to labor productivity growth are quantified for a sample of countries, using data envelopment analysis techniques. Regression analysis shows that the observed patterns were mainly driven by processes of creating spillover potential through capital intensification. Assimilation appears to be much slower than assumed in Basu and Weil’s model.

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1. Introduction

Recently, [Basu and Weil \(1998\)](#) introduced a new theoretical model of international productivity growth dynamics, which could generate patterns of international productivity convergence and divergence that are more in line with reality than the results obtained from other endogenous growth models. These patterns are the net result of two opposing forces in the model. Like in the [Solow \(1956\)](#) model, it is assumed that new knowledge about production technologies is immediately public. These spillover effects imply tendencies towards convergence of productivity growth rates. Tendencies towards divergence are caused by the novel assumption that new knowledge is only ‘appropriate’ for countries that produce according to technologies similar to the innovator’s technology. Such countries will reap the gains from innovation immediately, whereas other countries will not benefit at all. In this set-up, if innovation would take place at similar rates across technologies, the well-known Solow results would follow. [Basu and Weil \(1998, henceforth denoted as BW\)](#), however, assume that innovation is ‘localized’ at high-end technologies.¹ Countries that operate low-end technologies could thus fall behind the world’s technology leaders. The aim of this paper is twofold. First, and most prominently, it tries to give quantitative indications of the importance of localized innovation and BW’s notion of appropriate technology spillovers for patterns of convergence and divergence. Second, the empirical validity of the assumption of immediate spillovers of appropriate technology will be investigated. Spillovers appear not to be immediate and arguments will be put forward that the speed of spillover assimilation should be regarded as a third determinant of labor productivity growth.

The empirical analysis will be based on a recently proposed decomposition of productivity growth, which makes use of data envelopment analysis (DEA) techniques ([Kumar and Russell, 2002](#)). This methodology will be slightly modified, by adopting an intertemporal perspective suggested by [Tulkens and Vanden Eeckaut \(1995\)](#) that is in line with properties of the BW model. Labor productivity growth rates are decomposed into three parts, which will be interpreted as effects of the three sources of growth identified above: localized innovation, assimilation of knowledge spillovers, and creating potential for appropriate technology spillovers through investment. This methodology will be applied to Penn World Tables data on GDP, labor inputs and capital inputs for a set of 53 countries for the period 1965 to 1990. In a second stage, the decomposition results will be used in a convergence analysis based on regression techniques. Additional outlier analysis investigates how the three sources of growth contributed to the extraordinary performance of growth ‘miracles’ and ‘disasters’, i.e. countries that experienced very high or low productivity growth rates, even after correction for potentially favorable initial conditions.

The rest of the paper is organized as follows. In Section 2, the BW model and the decomposition framework will be discussed in more detail and the relation between the theoretical and empirical approaches will be shown. Section 3 is devoted to a discussion of the data and the estimation of the reference production frontier, that is, the set of best-practice production processes. In Section 4, convergence and divergence of labor productivity growth rates and their three sources will be studied. Section 5 deals with an

¹ The term “localized innovation” was first coined by [Atkinson and Stiglitz \(1969\)](#).

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