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Journal of Asian Economics 17 (2006) 852–866
Journal of Asian Economics

An estimation of growth model for South Korea using human capital☆

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Received 21 July 2005; received in revised form 10 August 2006; accepted 14 August 2006

Abstract

This paper tests the hypothesis of nondecreasing returns to scale in physical capital and human capital. The results cannot support the nondecreasing returns to scale hypothesis, implying the acceptance of the neoclassical growth model and the inevitability of convergence toward the steady state. In Korea, physical capital does not seem to receive its social returns, suggesting the possibility of externalities. However, the test of externalities does not support it. The effect of externalities on TFP was examined and the presence of externalities due to human capital and exports was found only in the 1962–1990 data.

JEL classification : O42; O53

Keywords: Endogenous growth theory; Human capital; Estimation of the steady state growth; Nondecreasing returns to scale; Test of externalities

1. Introduction

In 1956, Solow published a seminal paper on economic growth and development entitled ‘‘A Contribution to the Theory of Economic Growth’’ (Solow, 1956). The basic assumptions underlying this neoclassical model are as follows: first, technology is exogenous, that is, the technology available to firms is unaffected by the actions of the firms, including research and development. Second, production function exhibits constant returns to scale in capital and labor

☆ This article is based on the article which was previously appeared in the Korean Journal of Money and Finance, Vol. 5, No. 2 (Special Issue), November 2000, pp. 189–220.

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doi:10.1016/j.asieco.2006.08.004

jointly, but diminishing returns to scale in capital and labor separately.[1] The key implication of these assumptions is that an economy has a tendency to converge to a steady state in which per capita GDP would grow at a constant rate; therefore, any policy-induced ''catch-up'' may generate a rapid growth for underdeveloped economies only for a period of time, but the growth rate will eventually decelerate to the rate of exogenous technological change as the GDP gap between the developing economies and advanced economies is narrowed.

However, by the 1980s it became more and more apparent that the neoclassical theory was inadequate in explaining the remarkable growth of newly emerging economies, especially that of the East-Asian economies. Out of this tension emerged a ''new'' growth theory which has come to be characterized as ''endogenous'' growth models. These models, developed by Romer (1986, 1987, 1990) and others gave focused on the role of human capital (i.e., ideas) as a main source of nondecreasing returns to scale.

In the new growth theory, growth may continue indefinitely because the returns to capital in a broad class of capital goods, including human capital, may not necessarily diminish as economies grow. Instead of assuming that growth occurs because of exogenous improvement in technology, the endogenous growth theory focuses on the economic forces underlying technological progress. It recognizes that technological progress occurs as a result of the profit maximizing behavior of firms. Romer endogenizes technology progress by introducing the search for new ideas by researchers interested in profiting from their invention. In this model, ''long-run'' growth is driven primarily by the accumulation of knowledge (or human capital). Lucas draws on the theory of human capital in which each individual acquires productivity-enhancing skills by devoting time to such acquisition and away from paying work. The acquisition of skills by a worker not only increases his productivity but has a spillover effect on the productivity of all workers by increasing the level of skills in the economy as a whole. The spillover effect of human capital in the Lucas model and of the knowledge in the Romer model are externalities not internalized by individual agents. However, for the economy as a whole, they generate increasing scale economies even though the perceived production function of each agent exhibits constant returns to scale. The central point in their theory is that if the investment takes place under nondecreasing returns to scale, the marginal product of capital need not decline over time; hence, the incentive for capital accumulation may persist indefinitely.

The main objective of the present paper is to test the key proposition of the endogenous growth model, namely the constant returns to scale in both physical and human capital using time series data for South Korea for the two overlapping periods, 1962–1990 and 1954–1990. The former represents the periods of rapid growth, while the latter includes all available data. The 1962–1990 data is likely to be of better quality than the 1954–1990 data. The test is conducted by estimating the augmented Solow (steady state) model, incorporating human capital in the production function. This paper also examines Lucas' double effects of human capital accumulation: internal effects and external effects. The internal effect is the direct, the marginal product of capital for which the owner of the human capital is paid. The external effect is the externalities, the benefit available to others which the private individual may not realize. We also test for the externalities of exports, along with interaction effects among several key variables.

[1] We say that production function is neoclassical if (a) for all $K > 0$ and $L > 0$, the function exhibits positive and diminishing marginal products with respect to each input; (b) the function exhibits constant returns to scale in K and L combined; (c) the marginal product of capital (or labor) approaches infinity as capital (or labor) goes to zero and approaches zero as capital (or labor) goes to infinity. These last properties are called Inada (1963) conditions (Barro & Sala-I-Martin, 1995).