

# Measurement of human capital input across countries: a method based on the laborer's income

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## Abstract

I propose the aggregate output divided by the wage rate of an industrial laborer in a country as a measure of the aggregate human capital input for that country. I use this method to compare the human capital inputs for 45 countries of diverse output levels. I find that human capital input differs between the lowest-income and the highest-income countries by a factor of 2.2 or 2.8, depending on the inclusion of outlier countries. This is significant but small relative to the results from the method based on years of schooling. © 2002 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

Lucas (1988) and many others have proposed the differences in human capital input as a major source of output differences across countries. In order to evaluate this view, a measure of human capital inputs across countries is necessary. Conceptually, human capital input is the labor input in the production adjusted for quality in terms of skills and health. The difficulty in its measurement lies in this adjustment. It is not easy to say how much more (or less) human capital input an hour of work by a doctor in the US is when compared with an hour of work by a laborer in Nigeria. In this paper, I propose a

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method of measuring human capital input that relies on the laborer's income and conduct a measurement exercise based on this method.

Broadly, there are two approaches to measuring human capital. One, the cost-based approach, measures the cost of human capital investment. For an international comparison of the human capital, the most common measure of the cost is the years of schooling. The measurement exercises based on the years of schooling include Kyriacou (1991) and Barro and Lee (1993). In comparing human capital *input* across countries, it is assumed that the years of schooling embodied in living (and working) people are proportional to the human capital input supplied by these people. This assumption is implicit, for example, in the growth accounting exercise of Mankiw et al. (1992). The popularity of the measurement method based on the years of schooling seems to stem from the fact that it directly relies on educational investment, which is considered a key element for human capital formation. However, this method has some shortcomings. First, it does not measure the human capital acquired outside the school: skills acquired before schooling, in job training outside the school and in the workplace. A worker with no schooling clearly has a human capital to the extent that he is contributing to the production. Skills acquired in the workplace, especially, may differ greatly between the workers in low-income countries and workers in high-income countries. Second, this method does not measure human capital in terms of health, which is an important factor in labor productivity. Human capital in terms of health may differ greatly between low-income and high-income countries. Third, the measurement using the years of schooling implicitly assumes that the formation of human capital per year of schooling is the same in all countries. The quality of education may vary greatly across countries, especially between the low-income and the high-income countries, leading to different quantities of human capital formation per year of schooling. Fourth, the measurement using the years of schooling implicitly assumes that the formation of human capital per year of schooling is the same at all levels of schooling. One can conjecture that the marginal formation of human capital decreases as the duration of schooling increases and is the same as the marginal cost at the point when schooling stops. This conjecture is supported by the finding that the return to primary education is higher than the return to secondary education, which is higher than the return to tertiary education (Psacharopoulos, 1994).

The other approach, the income-based one, uses the labor income differences across workers with various levels of human capital to measure human capital inputs. Income differences across workers are the differences in the market values of their human capital inputs and are largely determined by the differences in their human capital inputs. The differences in the human capital input could then be derived from the income differences by eliminating the part of the differences due to the factors other than human capital input. For example, Krueger (1968) classifies workers by education level, age and sector where they work (urban or rural) in a sample of 21 countries, with the assumption that two workers of the same type, across countries as well as within a country, supply the same human capital input. She derives the aggregate human capital input for each country by weighing the inputs of different types of workers by their average labor incomes in the US. This method, unlike the method based on the years of schooling, allows the differences in human capital formation per year of schooling across education levels since these differences would be reflected in income differences. However, this

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