Economic Growth, spring 2007
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Outline:
Endogenous Growth Through Factor Accumulation, Part II: Human Capital

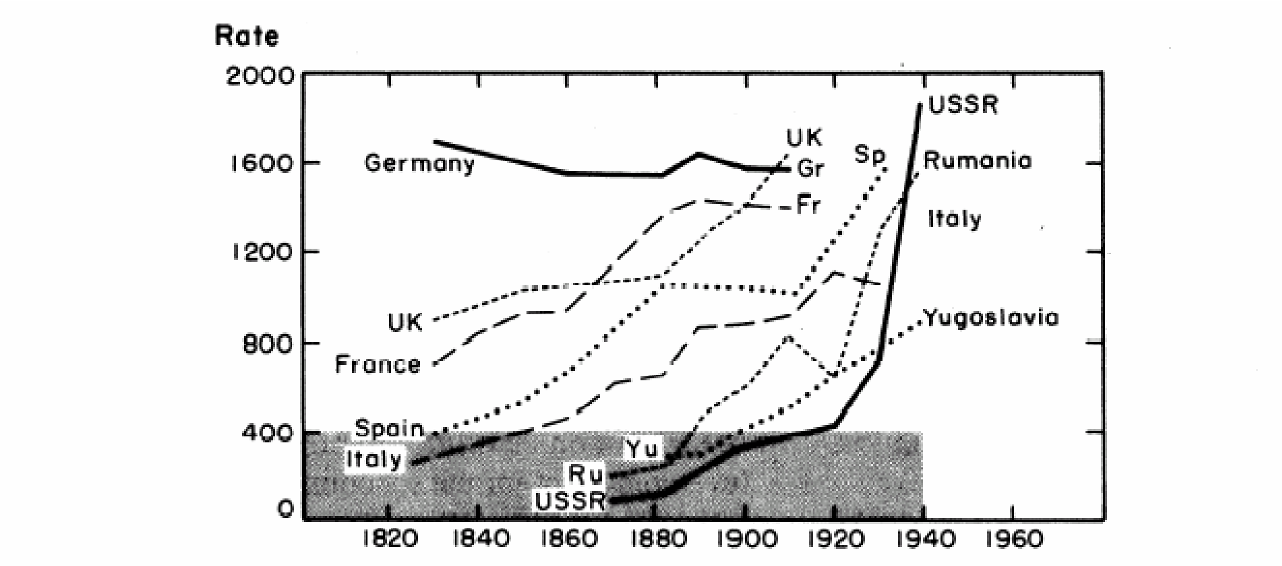
I. Introduction

II. A Simple Model: Uzawa-Lucas meets Solow (Lucas, 1993)

III. Endogenous savings and educational choice
  a. **Conditions for endogenous growth in two sector models**
  b. **The Uzawa-Lucas model**

IV. Empirics (Bills & Klenow, Hendricks)

INTRODUCTION



Source: Easterlin, 1981.

Much like persistent economic growth in GDP per capita; widespread literacy is a fairly recent phenomenon. Perhaps a clue that human capital is critically important for the growth process?

We have already studied the implications of one form of human capital in the context of endogenous growth: Learning-by-doing generated human capital.

What about formal schooling? Our basic approach was that due to Mankiw, Romer and Weil (1992) [MRW]

Human capital in the MRW sense: Investment of income -> human capital (e.g. tuition, symmetrical technology in goods and human capital production).

Empirical implementation: Enrolment rates in secondary schooling

Estimation: find a = 1/3, b = 1/3. Suggest *very* large impact from schooling.

Consider implied difference in income per worker between US (School = 11.9), and Mali (School = 1)

$$\ln y_{US} - \ln y_{Mali} = \frac{\hat{\alpha}}{1-\hat{\alpha}-\hat{\beta}}\left[\ln(11.9) - \ln(1)\right] = 4.95$$

Which implies a productivity difference of exp(4.95) = 141!

Micro foundations: The labor literature examines the impact from *education* on individual productivity. Formally the "Mincerian" approach consists of estimating wage equations like

$$\ln w_i = \ln w_0 + \beta u + X'\alpha$$

u = years of schooling. X = other controls (experience etc…)

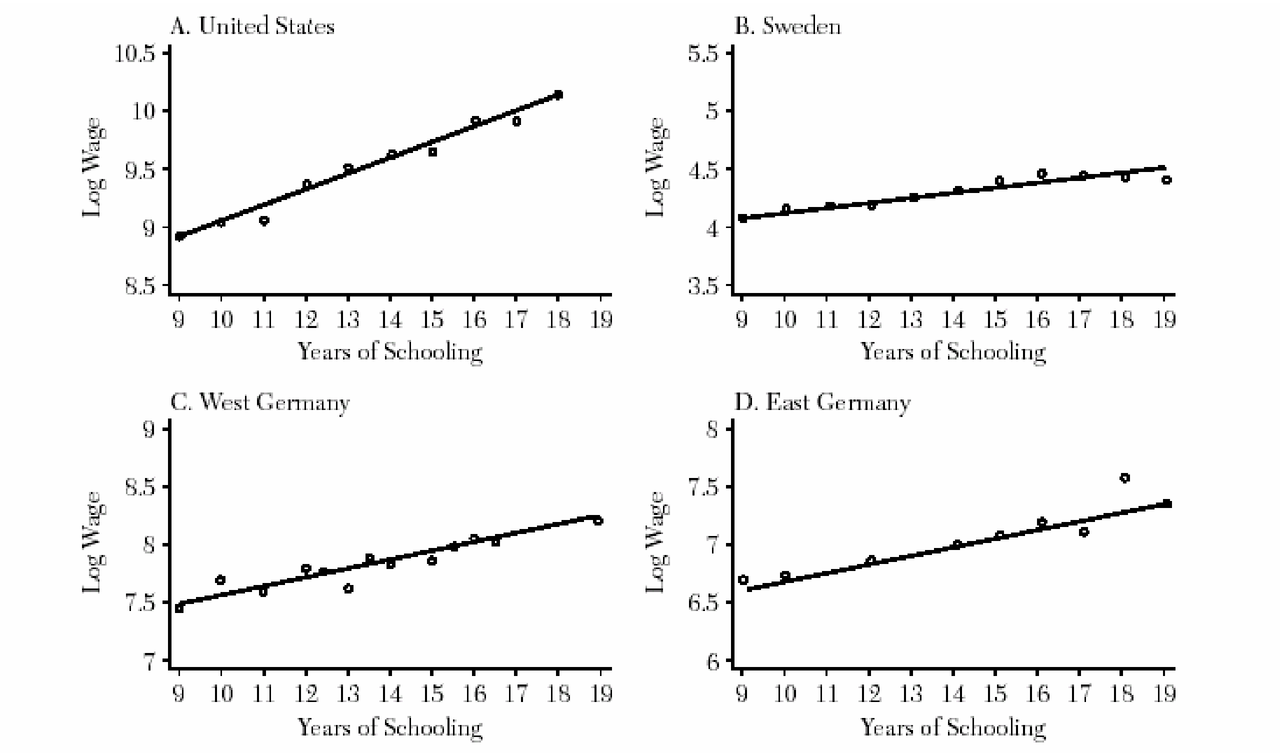


Figure 1. Unrestricted Schooling-Log Wage Relationship and Mincer Earnings Specification

S*ource: Krueger and Lindahl, JEL, 2001*

Typically, labor economists find β to be around 10 %; which implies, taken at face value, *much* lower differences in productivity. Consider the following way to model human capital:

$$Y = K^{\alpha}(AhL)^{1-\alpha} \Leftrightarrow Y = LA(K/Y)^{\frac{\alpha}{1-\alpha}}h$$

$$w(h) = \partial Y/\partial L = (1-\alpha)A(K/Y)^{\frac{\alpha}{1-\alpha}}h,$$

$$\ln w(h) = \ln w(0) + \ln h = \ln w(0) + Bu; h = e^{Bu}$$

So if B=0.1, the implied difference in income per capita between country i and j is given by

$$e^{B(u_i-u_j)}$$

So 1 year difference translates into (B=) 10% difference in Y/L. Implication: Differences in schooling can *account* for relatively small differences in Y/L (see Caselli, 2004 § 1 & 2)

A related approach:

Wage difference between two workers with different levels of schooling:

$$\ln w(h_1) = \ln w(h_0) + \ln h_1 - \ln h_0$$

Suppose w(h1) refers to the wage at *time* 1, and w(h0) the wage a time 0. The % change in wages is proportional to the change in the human capital stock. Inspired by Mincer approach; suppose the change in human capital stock is proportional to years of schooling.

$$\ln(w_1 / w_2) = \ln(h_1 / h_0) = Bu_{01}$$

But this suggests a formulation such as

$$\dot{h} / h = Bu \Leftrightarrow h(t) = h(0)e^{But}$$

This matters a great deal. Implied difference in income per capita between country i and j is now given by

$$\frac{h_i(0)}{h_j(0)} e^{B(u_i - u_j)t}$$

In standard levels accounting one may be missing the first term; thus potentially underestimating the importance of h.

Under this interpretation, moreover, persistent differences in u would lead to a diverging process for h (i.e. note the presence of *t*); huge productivity differences in the long-run.

Can h grow forever? Quantity vs quality.