A Simple Mincerian Approach to Endogenizing Schooling

Charles I. Jones

Department of Economics, U.C. Berkeley and NBER
E-mail: chad@econ.berkeley.edu
http://www.econ.berkeley.edu/~chad

April 24, 2007– Version 0.5

This brief note is an excerpt from an earlier draft of my "Intermediate Goods and Weak Links: A Theory of Economic Development" paper. It explains a simple way to endogenize schooling differences across countries based on Mincer (1958). Just as with physical capital, individuals accumulate human capital until the rate of return falls to equal an effective interest rate.

1. INTRODUCTION

This brief note presents a simple Mincerian approach to endogenizing schooling that can be embedded in any theory of development. The specification below is closest to that in Mincer (1958). Richer models of human capital include Ben-Porath (1967), Bils and Klenow (2000), and Manuelli and Seshadri (2005). The approach here is purposefully stripped-down, trading generality and realism for simplicity and tractability.

This was originally included in an earlier draft of my paper, "Intermediate Goods and Weak Links: A Theory of Economic Development." More recently, I have simplified that paper and cut the section on endogenizing schooling. Still, it may be of some use in other papers. I certainly feel it is a better theoretical approach to schooling than the simple approach taken by Hall and Jones (1999): it delivers the same empirical predictions but with a theory of human capital that explains *why* Mincerian returns are so close to interest rates.

I'm sure this approach is already well-appreciated in the literature on human capital, and I don't at all mean to claim that this is new in any way.

2. THE MODEL

Aggregate human capital H is labor in efficiency units: $H = hL$, where h is human capital per worker and L is the number of workers. Assume the (constant) population in a country is distributed exponentially by age and faces a constant death rate $\delta > 0$: the density is $f(a) = \delta e^{-\delta a}$. A person attending school for S years obtains human capital $h(S)$, a smooth increasing function. The representative individual's problem is to choose S to maximize the expected present discounted value of income:

$$\max_S \int_S^\infty w_t h(S) e^{-(\bar{r}+\delta)t} dt, \tag{1}$$

where the base wage w_t is assumed to grow exponentially at rate $\bar{g}$.

Solving this maximization problem leads to the Mincerian return equation:

$$\frac{h'(S^*)}{h(S^*)} = \tilde{r} \equiv \bar{r} - \bar{g} + \delta. \tag{2}$$

The left side of this equation is the standard Mincerian return: the percentage increase in the wage if schooling increases by a year. The first order condition says that the optimal choice of schooling equates the Mincerian return to the effective discount rate. In this case, the effective discount rate is the interest rate, adjusted for wage growth and the probability of death. The original Mincer (1958) specification pinned down the Mincerian return by the interest rate. The generalization here shows the additional role played by economic growth and limited horizons. Rather than being an exogenous parameter, as in the simple version of Bils and Klenow (2000) used by Hall and Jones (1999) and others, the Mincerian return in this specification is related to fundamental economic variables.

More progress can be made by assuming a functional form for $h(S)$. Consider the constant elasticity form $h(S) = S^\phi$. In this case, the Mincerian return is

$h'(S)/h(S) = \phi/S$, so the Mincerian return falls as schooling rises. The first-order condition in equation (2) then implies the optimal choice for schooling is

$$S^* = \frac{\phi}{\bar{r} - \bar{g} + \delta}, \tag{3}$$

and the human capital of the labor force in efficiency units is

$$h^* = \left(\frac{\phi}{\bar{r} - \bar{g} + \delta}\right)^{\phi}. \tag{4}$$

We assume ϕ is the same across countries, so differences in schooling can be explained in this simple framework by differences in the effective discount rate. A higher interest rate, slower growth, and a higher death rate all translate into lower educational attainment.

People in this world go to school for the first S^* years of their lives and then work for the remainder of their lives. Anyone working has S^* years of schooling and therefore supplies h^* efficiency units of labor for production.

2.1. Calibration

We assume the interest rate for discounting future wages is 6% in the rich country and 12% in the poor country. Such values are well within the range of plausibility; see, for example, Caselli and Feyrer (2005).

We take a growth rate of 2% per year for the rich country and a growth rate of zero for the poor country. Many of the poorest countries of the world have exhibited essentially zero growth for the last forty years.

For the death rate, we assume $\delta = 1\%$ per year in the rich country and 2% per year in the poor country. With this constant probability of death, life expectancy is 50 years in the poor country and 100 years in the rich country.

These parameter values imply a Mincerian return to schooling of 5% in the rich country and 14% in the poor country. We also take $\phi = 0.6$. Together with the other parameter values, this implies people in the rich country get 12 years of schooling, while people in the poor country get 4.3 years of schooling. These numbers are not a perfect match of the data (one might want a slighly smaller

gap in the Mincerian returns and a slightly larger gap in the years of schooling, as documented by Bils and Klenow 2000), but they are certainly in the right ballpark, which is a nice accomplishment for the simple schooling framework used here.

REFERENCES

Ben-Porath, Yoram, "The Production of Human Capital and the Life Cycle of Earnings," *Journal of Political Economy*, August 1967, *75* (4), 352–365.

Bils, Mark and Peter Klenow, "Does Schooling Cause Growth?," *American Economic Review*, December 2000, *90*, 1160–1183.

Caselli, Francesco and James Feyrer, "The Marginal Product of Capital," August 2005. NBER Working Paper 11551.

Hall, Robert E. and Charles I. Jones, "Why Do Some Countries Produce So Much More Output per Worker than Others?," *Quarterly Journal of Economics*, February 1999, *114* (1), 83–116.

Manuelli, Rodolfo and Ananth Seshadri, "Human Capital and the Wealth of Nations," March 2005. University of Wisconsin working paper.

Mincer, Jacob, "Investment in Human Capital and Personal Income Distribution," *Journal of Political Economy*, August 1958, *66* (4), 281–302.