
ECONOMIC GROWTH, POPULATION THEORY, AND PHYSIOLOGY: THE BEARING OF LONG-TERM PROCESSES ON THE MAKING OF ECONOMIC POLICY

ROBERT WILLIAM FOGEL

En proceso de edición de la revista No. 93 se recibió una nueva versión del citado artículo. Los principales cambios tienen que ver con las notas 6 y 8 que reproducimos a continuación. Se han hecho pequeños pero significantes cambios a la nota 6. La nota 8 ofrece una nueva versión y se han agregado algunas ecuaciones.

6. Premature mortality is defined here as death rates higher than the 1980 death rates when standardized for the 1700 age structure (cf. Fogel 1986 and 1992b). Estimates of the overall death rate c.1790 are from Wrigley and Schofield (1981). Estimates of the relative death rates by deciles of the caloric consumption distribution were based on the estimated average heights and BMI in these deciles and on the relative mortality risks that they imply, as indicated in **Figure 4**. For further details on the computations see the appendix in Fogel and Floud 1994 and **Table A2** in Fogel 1993 b.

8. The discounted present value of the age-earnings profile for n years beginning with the age at which earnings peak is given by:

$$(1) P_x = E_x \int_0^n e^{-(\mu - \phi - r)t} dt$$

where μ is the rate of decline in the survivorship function (the l_x curve of the life table), ϕ is the rate of decline in annual net earnings after age x ; r is the discount rate (which, for convenience, is set at six percent), x is the age at which earnings peak, E_x is net earnings at that age, n is the average number of years that elapsed between x and the average age at which a living male ceased to be in the labor force regularly (which, for convenience, will be taken to be equal to 35), and P_x is the discounted present value of the net earnings stream.

The value of μ for 1790 was computed from Wrigley and Schofield (1981), taking the average of their e_0 for 1786-1795 (which is 36.63) and interpolating between levels 8 and 9 in their family of English life tables to obtain the proper l_x curve for c. 1790. The value of μ over ages 35-70 in that schedule is 0.0289.

The projected shift in the l_x curve was based on the Waaler surface in **Table A1**, Fogel 1993b. Using 1.68m and 61kg for 1790, and 1.76m and 76kg for 1980, yields a predicted decline of 31 percent in the mortality rate. The corresponding l_x schedule was obtained from Princeton model North tables at male level 14, using 0.69 (${}_{35}m_{35}$) as the basis for the fit. The

value of μ between ages 35-70 in that l_x schedule is -0.0202.

The changes in E_x associated with changes in height and weight were estimated from an equation reported by Robert A. Margo and Richard H. Steckel (1982). The data they used pertained to slaves seized as booty of war by the Union Army in 1863. The traders who related the value of slaves to their height and weight appear to have focused only on the differences in the location (not the slope) of the age-earnings profile, showing no apparent awareness of the relationship of stature and BMI to mortality and chronic diseases (cf. Fogel 1992c). The Margo-Steckel equation is:

$$\begin{aligned}
 (2) \ln V &= 2.73 + 0.032S + 0.17A - 0.005A^2 \\
 &\quad (1.47) \quad (0.92) \quad (2.22) \quad (-2.23) \\
 &+ 0.000046A^3 + 0.053H + 0.019W \\
 &\quad (2.10) \quad (2.16) \quad (1.79) \\
 &- 0.00027H.W; \quad N = 523; \quad \bar{R}^2 = 0.20; \\
 &\quad (-1.73)
 \end{aligned}$$

Where V is the value of a slave, S is a dummy for skin color, A is age, H is height (in inches), and W is weight (in lbs). T-statistics are in parens. For 1790 I used 66.1 inches and 134 lbs. For 1980 I used 69.3 inches and 167 lbs. These figures indicate that E_x increased by about 7 percent as a result of changes associated with body size.

The value of ϕ for 1790 between ages 35 and 70 was computed from data reported in Fogel and Engerman 1974. These data indicate that net earnings at age 70 were about 17 percent of peak earnings, which was attained at age 35.

With the foregoing information and an initial assumption that ϕ remained constant, the increase in P_x can be computed from the data shown in equations (3) and (4):

$$(3) P_{x,1790} = \frac{E_x \left[1 - e^{-(0.0289 - 0.0494 - 0.06)35} \right]}{0.1383} = 7.17E_x$$

$$(4) P_{x,p} = \frac{107E_x \left[1 - e^{-(0.0202 - 0.0494 - 0.06)35} \right]}{0.1296} = 8.17E_x$$

where $P_{x,1790}$ is the present value of the 1790 earnings profile and $P_{x,p}$ is the present value of the profile projected from the changes in height and BMI. Equations (3) and (4) imply that P_x increased by about 14 percent $[(8.17+7.17)-1=0.14]$.

It is now necessary to take account of the effect of changes in body size on the rate of decline in the net earnings function (the value of ϕ). If it is assumed that net earnings at age 70 rose from 17 to 40 percent of peak-age earnings as a result of physiological improvement, P_x increases by 37 percent. However, even the last figure is probably too low since it does not take account of the secular shift in the peak of the age-earnings profile from the mid-thirties to the mid-forties. Moreover, studies of the profiles of manual workers in recent times suggest that net earnings now decline much more slowly after the peak than in past times (cf. Fogel and Engerman 1974; Jablonski, Rosenblum, and Kunze 1988; Murphy and Welch 1990).