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Life expectancy, human capital, social security and growth

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Abstract

We analyze the effects of changes in the mortality rate upon life expectancy, education, retirement age, human capital and growth in the presence of social security. We build a vintage growth, overlapping generations model in which individuals choose the length of education and the age of retirement, and where unfunded social security pensions depend on workers' past contributions. Social security has a positive effect on education, but pension benefits favor reductions in retirement age. The net effect is that starting from a benchmark case, higher life expectancies give rise to lower per capita GDP growth in the presence of social security as the share of the active population is reduced. In addition, higher social security contribution rates reduce the growth rate of per capita GDP.

JEL classification: O40; H55; J10
Keywords: Mortality Rate; Social Security; Growth

1. Introduction

The relationship between life expectancy at birth and per capita GDP growth has been studied both empirically and theoretically. Regarding the empirical evidence, the hypothesis that reductions in the mortality rate has a non monotonic relationship with per capita GDP growth is mostly supported. By using time series data, Rodriguez and Sachs (1999) find a positive effect from life expectancy to per capita GDP growth in Venezuela between 1970 and 1990. However,

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Malmberg (1994) finds a negative relationship in Sweden between 1950 and 1989. Analysis of cross section data also shows that this relationship is not monotonic. Preliminary data from Latin American and Caribbean countries indicate that the GDP growth rate is positively associated with life expectancy. [See World Health Organization (1999), Box 1.2, p. 9.] Barro and Sala i Martín (1995), using a sample of 97 countries, estimate that an increase in life expectancy of 13 years would increase the per capita growth rate by 1.4% per year. Zhang and Zhang (2005) show a clear, positive relationship, but at a diminishing rate. Still, other studies have found mixed evidence: increases in life expectancy have followed higher growth rates when life expectancies are low, but have followed lower growth rates when life expectancies are high. [See Zhang et al. (2003) and references therein].

Theoretical work mostly assumes that *human capital* accumulation is the engine of growth. Some studies conclude that the relationship is always positive, whereas others obtain an inverted *U* pattern. Among the former are Ehrlich and Lui (1991) and Hu (1999). In these models, higher life expectancy increases the length of time in which the return to human capital investment is received, thus allowing for higher rates of return, and, as a consequence, higher investment and per capita GDP growth rates.[1]

Still, other works have obtained an inverted *U* pattern between life expectancy and per capita GDP growth, which is consistent with the mixed empirical evidence mentioned above (both from historical and cross-section data). De la Croix and Licandro (1999) posit an economy where the effect of a reduction in the mortality rate upon the duration of education is such that the per capita GDP growth rate becomes higher for high mortality rates (as in underdeveloped countries), but lower for low mortality rates (as in industrialized countries). The same result is obtained in Boucekkine et al. (2002) under a setting in which there is an uncertain lifetime horizon and *endogenous retirement age*. In both papers, labor is the unique input in production, and the intuition behind the negatively sloped part is that the average human capital of the labor force becomes more *obsolete* as life expectancy increases.[2] Zhang and Zhang (2003) and Zhang et al. (2003) also obtain this result but by a different channel: not through own education time, but through expenditure on children's education.

Assuming exogenous growth, a second line of research has produced a number of articles dealing with the connections between population aging, a *pay-as-you-go* social security and the retirement age. One recurring topic in this literature is the effect of social security upon workers' voluntary retirement age. Along these lines, the available empirical evidence suggests that, at least for the US economy, social security is relevant for retirement age issues, even though there is not total agreement on the effect of changes in the payout from the social security program. [See, *e.g.*, Diamond and Gruber (1997) and Coile and Gruber (2000).]

In this article, we study to what extent introducing unfunded social security affects the relationship between life expectancy and per capita GDP growth, taking into account the social security impact on education and retirement age incentives. Our starting point is Boucekkine et al. (2002). Boucekkine et al. used an overlapping generations model with uncertain, finite lifetime

[1] Echevarría (2003) shows in an *exogenous* retirement model in which human capital investment depends positively on the number of working periods until the individual's retirement that increases in life expectancy give rise to higher GDP growth rates *only if* it is accompanied by simultaneous exogenous increments in the active period (*i.e.*, delays in the retirement age).

[2] Building on Boucekkine et al. (2002), but allowing for *physical* capital along with human capital in a certain lifetime horizon, Echevarría (2004) obtains the same relationship.