

# Vintage Human Capital, Demographic Trends, and Endogenous Growth

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We study how economic growth is affected by demographics in an OLG model with a realistic survival law. Individuals optimally chose the dates at which they leave school to work and at which they retire. Endogenous growth arises thanks to the accumulation of generation-specific human capital. Favorable shifts in the survival probabilities induce longer schooling and later retirement but have an ambiguous effect on per-capita growth. The long-term relationship between fertility and per-capita growth is hump-shaped. Increases in longevity can be responsible for a switch from a no-growth regime to a sustained growth regime and for a positive relationship between fertility and growth to vanish. Solving numerically the equilibrium, demographic changes can have important medium-term effects even if long-term changes are very small. *Journal of Economic Literature* Classification Numbers: O41, I20, J10. © 2001 Elsevier Science (USA)

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## INTRODUCTION

The relationship between demographic trends and economics is a challenging area of research. Life expectancy at birth was below 50 years at

the beginning of the century in Western Europe and it is it now reaching 80. The importance of the economic growth process in fostering such improvements has been stressed by Fogel [20], but the effect of past and future demographic trends on growth remain largely unexplored. One likely channel through which demographics affect growth is the size and quality of the work force. The aim of this paper is to study the effect of key demographic parameters on human capital accumulation and economic growth.

A first reason to study the effect of demographic trends on growth appears when we consider how big the demographic changes have been in the last centuries. Crude death rate (deaths in % of population) started to decline in France and United Kingdom during the eighteenth century. At the beginning of the twentieth century, the decline in crude death rate was slowed down by the progressive ageing of the population. Life expectancy at birth continued to increase (and there is no reason to believe that this increase will not continue in the future): according to Vallin [35], it jumped from 25 years in 1740 to 51 years at the beginning of the twentieth century, and to 75 years in 1980. Much of the decline in mortality stems from a dramatic reduction in infant mortality during the early part of the period. In the twentieth century, the increasing distance between the survival law in 1899 and the one in 1969 for the ages 20–60 indicates that adult mortality has been decreased substantially (see Fig. 1). Moreover, Ehrlich and Chuma [17] report that the rate of increases of the life expectancies of the relatively older cohorts has been larger than that of the younger ones (for the United States).

Despite this huge drop in mortality, the growth rate of population, which is equal to the fertility rate minus the death rate plus net migrations, has not been so affected in Western Europe, see Table I. Indeed, empirical studies show that the fall in mortality rates is eventually followed by a steady and continuous decline in fertility (see Ehrlich and Lui [18]). In most parts of the European continent, fertility has now reached or even fallen below the replacement level. The future scenario of a zero population growth is now considered seriously. Finally, one remarkable feature of the last two centuries is the continuous increase in the time spent at school.

The need to model the vintage structure of the population provides the second motivation of the paper. Indeed, the empirical debate on the effect of demographics on economic growth stresses the importance of age-specific population characteristics (death rate, activity rate, education ...). Let us review briefly this literature. In their empirical study of the determinants of growth, Barro and Sala-I-Martin [2] stress the importance of life expectancy: a 13 year increase in life-expectancy is estimated to raise the annual growth rate by 1.4 percentage points. The authors think that life expectancy has such a strong, positive relation with growth as it proxies for

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