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Life expectancy and economic growth

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ABSTRACT

This paper investigates the relationship between life expectancy and economic growth in an overlapping generations model with family altruism where private and public investments in human capital of children are the engine of endogenous growth. Consistent with recent empirical evidence, our model provides a theoretical case of a non-linear pattern between life expectancy and economic growth. However, it is also shown that the emergence of such a pattern critically depends on the existence of intergenerational transfers in form of bequests. Specifically, we find that rising life expectancy unambiguously decreases growth if bequests are operative, whereas there exists an inverted-U shape relationship in economies where bequests are inoperative.

1. Introduction

The aim of this paper is to investigate the relationship between life expectancy and economic growth in an overlapping generations model with family altruism where private and public investments in human capital of children are the engine of endogenous growth.

Rapid increases in life expectancy are causing a significant shift in the global age structure. Recent estimates suggest that the number of people over the age of 60 is projected to reach 1 billion by 2020 and almost 2 billion by 2050, representing 22% of the world's population. Moreover, the proportion of individuals aged 80 or over is projected to rise from 1% to 4% of the global population between today and 2050 (UN, 2009). This development has raised concerns about a future slowing of economic growth as rising old-age dependency ratios translate into growing tax burdens and as political pressure may lead to a crowding out of public investment spending in favor of social spending on the elderly, with negative effects for capital accumulation and productivity growth.

However, empirical evidence on the life expectancy–growth relationship turns out to be mixed. Barro and Sala-I-Martin (1995) and Lorentzen et al. (2008) find in growth regressions that an increase in longevity is associated with higher growth rates, whereas Acemoglu and Johnson (2007) find no evidence of a positive growth effect. Also, the findings by Kelley and Schmidt (1995) and An and Jeon (2006) point to the existence of a non-linear relationship between aging and economic growth.[1] A non-linear relationship is further supported by some casual inspection of Fig. 1 which uses descriptive data from

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[1] More precisely, in economies where life expectancy is sufficiently low, as found in many developing countries, the net effect of an increase in life expectancy is to raise the growth rate. However, in economies in which life expectancy is sufficiently high such as it is found in most developed countries, the net effect of a further increase in life expectancy is to reduce the growth rate. See also Cervellati and Sunde (2011).

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the World Bank[2] and reports average growth rates of per capita GDP from 1960 to 1990 and 1980 to 2010 for countries with different initial life expectancy in 1960 and 1980, respectively. According to this figure, growth rates increase substantially as the initial life expectancy rises from below 60–69. However, when the initial life expectancy rises to 70 and over growth rates decline even though their levels are still higher than those in countries with low life expectancy.

To interpret these findings, we set up a simple discrete time overlapping generations model to analyze the effects of population ageing on per-capita growth. The main question addressed in this paper is, under which conditions of preferences and technology can an increase in life expectancy be good for growth? Despite the growing literature on this topic,[3] only few theoretical studies can explain a possible non-linear relationship: de la Croix and Licandro (1999) and Boucekkine et al. (2002) study a continuous overlapping generations model where individuals choose the length of time devoted to schooling before starting to work which is positively related to life expectancy. This positive effect on human capital formation may however be offset by an increase in the average age of the workers and thus a decline in the average stock of human capital. Using a discrete overlapping generations model, Zhang et al. (2003) examine the interactions between individual saving decisions and accidental bequests and show that the positive savings effect may be offset by a reduction in accidental bequests. Finally, Tabata and aging (2005) focuses on the impact of private health expenditures on individual savings. If life expectancy is sufficiently large, increasing health costs reduce savings and thus growth. In contrast to these studies, the current paper not only provides an alternative explanation of a non-linear relationship between life expectancy and economic growth but also clarifies the conditions under which such a pattern emerges.

Specifically, when altruistic individuals are concerned about the income level of their immediate descendants[4] and parents thus face a trade-off between educating their children or increasing their disposable income by leaving bequests, we show that there is a case for a non-monotonic relationship between life expectancy and economic growth when liquidity constraints prevent parents from leaving bequests. In such a situation, an increase in life expectancy speeds up capital accumulation as old-age consumption becomes relatively more important than investing into children's education and individuals therefore substitute voluntary savings for educational spending. If the indirect effect of faster capital accumulation outweighs the direct effect of lower educational spending, growth may increase. With operative bequests, however, the growth effect is unambiguously negative as the positive savings effect is offset by a reduction in the amount of bequests individuals devote to their children, implying a slow down of physical capital accumulation. Together with the direct negative effect of lower private educational spending, growth unambiguously declines.

Our model highlights the importance of private intergenerational transfers and individuals' reactions to changes in the economic environment in determining the consequences of population aging on economic growth. Our framework is relevant for countries with a well developed annuity market but with a lack of a loan market for education. For those individuals who cannot borrow adequately for their own education, human capital investment is largely made by their parents. Indeed, significant altruistically-motivated transfers of human capital take place in the family (Becker, 1991). Clearly, the focus of the analysis is thus on the later stage of the demographic transition, in which the main effect of increasing life expectancy is to raise the life-cycle ratio of years lived in old age relative to the number of years lived in the labor force. We abstract from child mortality and fertility choices (as in Zhang et al. (2003)), since in most developed countries both numbers are rather low with fertility rates being near or below the replacement level.

However, as has been recently emphasized by the literature on the political economy of population aging (see e.g. Zhang et al. (2003), Gradstein and Kaganovich (2004) and Gonzalez-Eiras and Niepelt (2012)), it is important to not only consider the direct growth effects of population aging but also the indirect effects working through adjustments in the choice of policy instruments. Therefore, we also study the case where young and old households vote over the size of public education expenditures. It turns out that the politically chosen tax rates are increasing functions of life expectancy that are always below their corresponding growth maximizing levels. As a result, the indirect growth effects are unambiguously positive and may thus mitigate, but not outweigh, possible negative direct growth effects. Hence, our findings are robust against alternative assumptions about the size of the public education programme.

The remainder is organized as follows. The next section introduces the basic model and derives the growth effects of increasing life expectancy when bequests are either operative or inoperative and tax rates are exogenously given. Section 3 studies the case when the size of public educational spending is determined by a probabilistic voting mechanism. Section 4 concludes. All proofs and some technical considerations are in Appendix A.

[2] See http://data.worldbank.org/. The data set contains 107 developing and developed countries for which the corresponding data are available. Note further that the displayed patterns are robust against variations in the chosen categories of life expectancy.

[3] For example, Futagami and Nakajima (2001), Liao (2011) and Gonzalez-Eiras and Niepelt (2012) find a positive effect of demographic aging on economic growth, whereas Bloom et al. (2010) suggest a modest decline in the rate of growth for developing countries. Furthermore, Zhang et al. (2001) show that the sign of the growth effect critically depends on the relative strength of the tastes for the number and welfare of children.

[4] The idea of the family altruism model originally goes back to Becker and Tomes (1979), who assume that parents care about the quality or the economic success of their children as measured by the children's lifetime income. Such an approach has been frequently used in growth models with human capital; see, e.g., Glomm and Ravikumar (1992), in which preferences depend on the quality of schools, which in turn are directly related to the disposable income of the children. Empirical evidence for the family altruism model is provided by Laitner and Justner (1996), who find that the amount of households' bequests is largest for those with the lowest assessment of children's possible earnings. See also Mankiw (2000), who argues that neither the Barro model nor the pure life-cycle model is best suited to analyze fiscal policy.