The Journal of the Economics of Ageing 7 (2016) 106–122

Contents lists available at ScienceDirect

The Journal of the Economics of Ageing

journal homepage: www.elsevier.com/locate/jeoa

Full length article

Demographic dividends, human capital, and saving ☆

Andrew Mason [a,*], Ronald Lee [b], Jennifer Xue Jiang [c]

[a] Department of Economics, University of Hawaii at Manoa, and Population and Health Studies, East-West Center, 2424 Maile Way, Saunders 542, Honolulu, HI 96821, United States
[b] Departments of Demography and Economics, University of California at Berkeley, 2232 Piedmont Ave, Berkeley, CA 94720, United States
[c] Department of Economics, University of Cambridge, United Kingdom

ARTICLE INFO

Article history:
Available online 3 March 2016

Keywords:
Human capital
Demographic dividends
Age structure
Fertility
Investment
Education

ABSTRACT

The objective of this paper is to provide new evidence about the development effects of changes in population age structure and human and physical capital. This extends our previous work by developing and employing a more comprehensive model of demographic dividends. In addition, we extend earlier analysis about the quantity-quality tradeoff using newly available NTA data for 39 countries, in contrast to the nineteen with the necessary data in our 2010 study. This permits a more detailed analysis, treating public expenditures and private expenditures separately, and considering the role of per capita income as well as fertility and child dependency in relation to human capital spending. The analysis is used in a simulation with realistic demography to show how human capital investment has varied in relation to the changing demography from 1950 to the present, and how it might be expected to change over the rest of this century.

These new estimates are then used in a more comprehensive model that incorporates both human and physical capital. The analysis provides estimates of the first and second demographic dividends and how they are affected by speed of fertility decline. The timing of the effects is documented and the relative importance of investment in physical and human capital is assessed. This improves our understanding of the economic implications of the demographic dividend and particularly the "second demographic dividend".

Introduction and background

Both rich and developing countries are experiencing dramatic changes in population age structure as a consequence of the demographic transition, post-world war II baby booms and busts, the emergence of very low fertility, and continuing improvements in life expectancy. All these changes combine transitory swings in age distribution with a secular trend toward aging populations. These changes bring both opportunities for intensified investments in human and physical capital to promote economic growth and challenges as support systems for the elderly are stressed and labor force growth slows or turns negative. Investment in human capital through mass formal education has increased dramatically in both developing countries over the past century and rich industrial nations over the past two centuries. On the one hand, increased human capital substitutes for the reduced supply of workers, and on the other hand the increase may be closely tied to the demographic forces that are leading to population aging, declining fertility and mortality. Health is another dimension of human capital, and investments in it have grown dramatically as well.

In Lee and Mason (2010) we used a stylized three age group OLG model in the spirit of Becker and Barro (1988), calibrated on data for nineteen countries around the world from the National Transfers Account project (NTA), to simulate the relation between human capital investment and demographic change over the demographic transition. We investigated the extent to which increased quality of workers might offset the falling support ratio due to slowing growth of quantity of labor. We found that under some plausible parameter values higher human capital could substantially offset the lower growth trajectory of workers. One goal of this paper is to refine and to elaborate on the analysis of human capital. We carry out a more detailed analysis of the relation of human capital spending to demographic and economic change.

☆ Lee's research for this paper was funded by the National Institutes of Health, NIA R37 AG025247. We are grateful to Michael Abrigo and members of the NTA network from the 39 countries for which we have used estimates. We are grateful to David Weil who gave us particularly valuable comments and suggestions on an earlier draft. We are also grateful to an anonymous referee who gave us exceptionally valuable comments.

* Corresponding author.
E-mail addresses: amason@hawaii.edu (A. Mason), rlee@demog.berkeley.edu (R. Lee), xj236@cam.ac.uk (J.X. Jiang).

http://dx.doi.org/10.1016/j.jeoa.2016.02.004
2212-828X/

We are able to draw on data for 39 NTA countries, in contrast to the nineteen with the necessary data in the 2010 study, permitting a more detailed analysis, treating public expenditures and private expenditures separately, and considering the role of per capita income as well as fertility and child dependency in relation to human capital spending. The analysis is used in a more realistic simulation that shows how human capital investment has varied in relation to the changing demography from 1950 to the present, and how it might be expected to change over the rest of this century, particularly up to 2050.

A second goal of this paper is to provide a more comprehensive model that incorporates both human and physical capital. In our past work, we have treated these separately while acknowledging the importance of both. Here we consider both. This will improve our understanding of the economic implications of the demographic dividend and particularly the "second demographic dividend", the term we use to refer to a second round of adjustments for the changing population age distributions over the demographic transition, including investment in human and physical capital, and increasing female labor supply.[1]

At the end of this paper we compare our approach and results to those from a similar study by Ashraf et al. (2013).[2]

Implementation and key results

The objectives of the paper are realized by simulating the development of a hypothetical economy during its transition from very high fertility and poverty to low fertility and higher standards of living. Realistic demography is incorporated into the model by using UN population estimates and projections for Nigeria, where the TFR remains above six births per woman. The economic model is generic, designed to capture important connections between population and economic development that are highlighted in the literature on demographic dividends. With minor exception, the model parameters are based on previous research and updated estimates of the relationship between human capital investment and fertility based on National Transfer Accounts data for many countries. The economic model does not incorporate any idiosyncratic features of the Nigerian economy.

A baseline simulation tracks economic outcomes in the event that fertility does not decline from its current level. This simulation is of interest only as a baseline against which we can compare alternative fertility scenarios. Any differences between simulations are attributable only to differences in fertility and the accompanying changes in human capital. It should be kept in mind, however, that fertility decline interacts with other variables in influencing the pace of development. Two of the fertility scenarios are based on alternative UN population projections – the medium and low fertility scenarios for Nigeria. The third scenario explores the possibility of radical fertility decline based on the experience in China during its unprecedented fertility transition.

The analysis shows fertility decline accompanied by an increase in human capital spending provides a substantial boost to economic growth. Some of the enhancement comes over the first thirty years as a consequence of the first demographic dividend. Given the low or medium fertility scenario per capita consumption will grow more rapidly by 0.4–0.6 percentage points between 2010 and 2040. The biggest gains come later, however. Per capita consumption growth is higher by about 1.5 percentage points between 2040 and 2100, the end point of the simulation. The large gains are a consequence of the second demographic dividend – the economic growth due to greater investment in physical and human capital. Radical fertility decline would produce gains that come earlier and would be substantially greater.

Background: human capital and economic growth

Does human capital foster economic growth?

A large literature has investigated the influence of education on economic growth through cross-national regressions (see review by Hanushek and Woessmann, 2012). Measuring educational attainment by mean years of schooling, as in the Barro and Lee (2010) data set, cross-national regressions typically find a robust positive effect on the rate of economic growth. Results are strengthened by refinement of the measure of educational attainment (Lutz et al., 2008). These effects are even stronger and more consistent when a measure of cognitive ability is used in place of grade attainment (Hanushek and Woessmann, 2012). There are critics of this line of research (Wolf, 2004; Aghion et al., 2009). In this paper we will simply assume that human capital (past investments in health and education) enters an aggregate production function as will be explained later and, thereby, contributes to economic growth.

Measurement

National Transfer Accounts takes a different approach than the studies mentioned above. The NTA estimates are based on estimates of public and private education and health expenditures on individuals by single years of age. Total human capital investment in each year is equal to total public and private spending on education and health of children and, in the case of education, young adults. Human capital of each cohort depends on the cumulative investment in the human capital to date in that cohort adjusted to reflect the extent to which members of the cohort are members of the workforce. Investment in human capital and the stock of human capital are, thus, treated in a fashion very similar to investment and the stock of physical capital.

Our NTA measure of human capital investment is dictated by the NTA accounting framework which provides comprehensive estimates of the costs or economic resources devoted to achieving education and health outcomes. NTA estimates do not include the value of the time of students nor do they include the value of the time of parents or grandparents who surely contribute to human capital of children and grandchildren.

The NTA educational expenditure measure described above should contain some useful information about quality of education, an important dimension. It also allows us to consider public and private investment data separately which may not be so important for European countries but which is extremely important in some other parts of the world such as East Asia, where private spending exceeds public in China, Taiwan, and South Korea although not Japan.

Fertility and human capital: the quantity–quality tradeoff

Becker's (1960) seminal paper introduced the idea that parents care about both the number and quality of their children, but the implications of this insight were not developed until Becker and Lewis (1973) and Willis (1973). Prettner et al. (2013) build on these insights in a more recent study. These analyses developed the consequences of the multiplicative interaction of quantity and quality of children in the family budget constraint, with each affecting the shadow price of the other. The demand for both

[1] Terminology differs, and some analysts include these effects in a single "demographic dividend".

[2] David Weil, one of the authors of this paper, suggested that we include a simulation of the effects of the United Nations Low Fertility scenario which would make it possible to compare results to the Ashraf et al. (2013) paper. This comparison is now included.