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Testing the Ben-Porath effect through the educational patterns of young cohorts

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ABSTRACT

During the 20th century, life expectancy levels have converged across the world. Yet, macroeconomic studies, as [Acemoglu, D., Johnson, S., 2007. J. Polit. Econ. 11 (6), 925–985.], estimate that improvements in health have no impact on growth or any factors of growth; in particular, they find no impact of life expectancy increases on education. We argue that their pessimistic results with respect to schooling investment is due to the use of an imprecise proxy. Indeed, when life expectancy increases at time *t, only the cohort born at t* should increase its human capital investment. On the contrary, [Acemoglu, D., Johnson, S., 2006. Disease and Development: The Effect of Life Expectancy on Economic Growth. Technical Report. National Bureau of Economic Research, Inc.] look at the impact of life expectancy improvements on the average education of *the whole working age population*, which evolves much slower. We have reproduced their estimations with a cohort-based measure of education[1] and find a positive and significant impact of life expectancy on education, of 20%–50%, which is in line with the expected magnitude of the Ben-Porath effect according to the theoretical literature.

1. Introduction

As stated by Jones and Romer (2010), the accumulation of human capital is a "new Kaldor fact", and understanding its determinants is a key issue for modern growth theory. As widely known, in developed countries, the great education transition from illiteracy to widespread completed secondary schooling has been concomitant with tremendous demographic changes. Economic theories rationalize the interplays between education investments and the demographic transition stylized facts, namely mortality decline, followed by fertility decline. In particular, on the mortality side, Ben Porath (1967) has put forward a mechanism which has become a keystone of modern growth theory.[2] It states that when life expectancy increases, human capital investments become more profitable, since the period during which its returns can be perceived is longer. Hence, an increase in life expectancy triggers a higher demand for schooling.

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[1] The updated Cohen-Soto data and those used in this paper are available on: http://www.parisschoolofeconomics.eu/en/cohen-daniel/international-educational-attainment-database/

[2] The Ben-Porath effect is a cornerstone of many overlapping-generation models (OLG) endogenizing demographic variables to explain the economic take-off in the long-run. See for instance Boucekkine et al. (2002) or Soares (2005) for models with exogenous mortality, and Cervellati and Sunde (2005) and De la Croix and Licandro (2007) for endogenized mortality.

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Developing countries have now all begun their demographic transition[3], and during the 20th century life expectancy levels have converged across the world. But human capital levels, proxied by mean years of schooling in the working age population, have not converged. This is a major puzzle, already pointed out by Cohen and Soto (2004). Would the Ben-Porath effect, while theoretically seducing, and widely used in modern growth theory, be refuted empirically?

Beyond raw data, macroeconomic empirical studies on the causal impact of life expectancy on education mostly draw pessimistic conclusions.[4] Acemoglu and Johnson (2007) use the epidemiological transition of the 1940s, a period when penicillin and DDT pesticide have spread throughout the world, to build an instrument for life expectancy at birth.[5] They conclude that the causal link of expected longevity on growth, and especially on human capital investments, is small and insignificant.[6] Lorentzen et al. (2008) instrument several proxies for health by climatic and geographic factors. Their estimations of the causal impact of mortality on economic growth are encouraging, but they still find no significant effect on education. Finally, Hazan (2012) shows that changes in life expectancy at 5, the age at which schooling decisions are taken, are uncorrelated with changes in average years of schooling for 60 countries over the period 1960–1990, and refutes the Ben-Porath mechanism on that basis.

These results are critical for the theoretical research on economic growth. Besides, they prevent us from hoping for a convergence in education levels worlwide, that would be triggered by convergence in life expectancies. Several research works have disputed the conclusions of Acemoglu and Johnson (2007). Aghion et al. (2011) have put forward that in a Nelson and Phelps (1966) framework, the initial level of life expectancy matters as much as its evolution for growth. But they do not test their specification with respect to schooling outcome. Cervellati and Sunde (2011) show that countries at different stages of the demographic transition do not all experience the Ben-Porath effect at the same strength. They find that a 1% increase in life expectancy level causes a 0.07–0.09 increase in average years of schooling in post demographic transition countries, but that the effect is insignificant in pre transition countries.

We argue in this paper that part of the reason why the debate erred on the empirical validity of the Ben-Porath mechanism is due to the choice of the human capital proxy to measure the education transition. The mean years of education in the working age population, widely used in this literature, is not relevant to test the Ben-Porath mechanism.[7] When life expectancy increases at time t, there is no reason why the working age population, which has already completed its education, should experience any increase in schooling attainments. Only the cohort born at t, or in age of schooling at t, will react to this change. Eventually, the average education of the working age population, which results from the *aggregation* of cohorts, will also increase if life expectancy improves durably.

It is crucial to understand that, in a period of transition, the average years of education in the *whole working age population*, and the average years of education of the *young cohorts*, do not evolve at the same pace. The working age population is an *aggregation* of cohorts of workers of different ages, who have completed their education at different dates, and who have faced different life horizons at the time when they decided on their education investment. According to the Ben-Porath effect, if a transition in life expectancy levels is initiated at time t, only the cohort still in age of schooling shall increase its education. This cohort will enter the labor force with a delay. But even then, it will constitute only a small part of the working population. The mean years of schooling in the working age population is a measure that averages the education of the newly educated cohort of young workers with older workers who have a very low level of education. Therefore the takeoff in life expectancy levels translates into a takeoff in education levels, but only for young cohorts. The takeoff in the average years of schooling in the whole working population is evidently delayed and lessened. On the contrary, at the end of the transition, when the education demand stagnates and young workers entering the labor force have the same high level of education than their predecessors, the increase in the average education in the working age population accelerates as old cohorts retire (or die). This phenomenon is theoretically underlined by Boucekkine et al. (2002). Fig. 1 pictures the evolution of these two measures from 1920 for a developed and a poor country: Sweden and Ethiopia. The difference in the trends between young cohorts and the working age population is spectacular.

We argue in this article that empirical tests of the Ben-Porath effect which use the average years of education in the working force as a proxy for education give very low or insignificant results indeed. But when applying the *same* empirical strategies to education of the cohorts in age of schooling at the time of the increase in life expectancy, we find on the contrary positive, significant, and robust results supporting the Ben-Porath mechanism.

We first present our data and recall that the expected magnitude of the Ben-Porath effect, according to the theoretical literature, is that an additional year of life expectancy translates on average into a 0.25–0.4 additional years of education. We then test this order of magnitude on a panel of countries over the period following the epidemiologic transition, 1940–1980. We test the Ben-Porath effect both for the *cohort* in age of schooling, and the working-age population (with a 20 year lead), to support our plea for the irrelevancy of the latter and the relevancy of the former. The education measures are taken from

[3] See Lee (2003)

[4] At the microeconomic level, Jayachandran and Lleras-Muney (2009), Miguel and Kremer (2004) or Bleakley (2007) find a positive causal relation of life expectancy on education.

[5] Note that their aim is not to test a time horizon effect but the effect of health on economic growth. Yet, they quote the Ben-Porath effect as one of the mechanisms that would justify a causal impact of health on economic growth. Besides, it is obviously very difficult to distinguish the effects of time horizon from the effects of heath.

[6] The test of the causal impact of the expected longevity on education is in their NBER working paper version of 2006.

[7] It is used in particular by Acemoglu and Johnson (2007), Cervellati and Sunde (2011), and Hazan (2012).