Journal of Economic Dynamics & Control 37 (2013) 2083–2103

Contents lists available at SciVerse ScienceDirect

Journal of Economic Dynamics & Control

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

Growth and enduring epidemic diseases ☆

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ARTICLE INFO

Article history:
Received 29 June 2009
Accepted 16 January 2013
Available online 29 April 2013

JEL classification:
I10
I20
O11
O40

Keywords:
Epidemic diseases
HIV/AIDS
Growth
Collapse
Pooling

ABSTRACT

This paper analyzes the interplay of human capital formation and economic growth when there is premature adult mortality. Failing adequate insurance arrangements, a long wave of such mortality can so undermine human capital formation as to induce an economic collapse. In nuclear family structures, random matching of partners is superior to assortative mating only if the shock is not too big and initial levels of human capital are not too low. Full pooling of mortality risks with equal treatment of all children in extended families may fend off a general collapse, depending on the initial conditions and the size and duration of the shock. To avoid undesirable effects on expectations, awareness campaigns should be complemented by policies that credibly promise to reduce future mortality. If mortality depends on the general level of human capital, indeterminacy can arise in the form of more than one rational expectations path.

1. Introduction

The great historical epidemic that springs to the European mind is the Black Death, which carried off about one-third of the entire population between 1347 and 1351. It has been argued that this demographic catastrophe undermined the feudal system and freed those societies from the burden of overpopulation. Historians are divided over the more elusive question of whether great plagues also left a cultural and psychological legacy of pessimism. McNeill (1976) is a leading protagonist of this thesis; but it is vigorously challenged by Cohn (2003), who observes that the plague was soon followed by the general optimism and individualism of the Renaissance.

The great modern plague is HIV/AIDS; but there are some striking differences. The first wave of the Black Death killed rich and poor, young and old alike, usually in a matter of days. AIDS is selective, and its individual course is normally lengthy and, until the end stages, free of symptoms. Its victims are overwhelmingly young adults and those in early middle-age, the great majority with children to care for. This selectivity is fundamental; for if parents die while their children are young, all the means needed to raise the children so that they can become productive citizens will be greatly reduced. The affected

☆ We thank Bernhard Pachl, Noemi Hummel, Maik Schneider, Martin Scheffel, and participants in seminars at Berkeley, Cornell, Heidelberg and the World Bank for their useful comments on earlier versions of this paper. We are likewise grateful to Elias Aptus and Boris Reiser, who rendered valuable assistance with the numerical calculations in Section 8. We are also much indebted to two anonymous referees and an editor of this journal for their constructive and insightful comments and suggestions. We alone are responsible for all remaining errors of analysis and opinion.

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http://dx.doi.org/10.1016/j.jedc.2013.04.011

families' lifetime income will shrink, and thus the means to finance education. The children will also lose the love and guidance which complement formal education. AIDS does much more, therefore, than destroy the existing abilities and capacities embodied in its victims; it also weakens the mechanism through which human capital is formed in the next generation and beyond. These ramifications will take decades to make themselves fully felt. All the while, the growing burden on surviving adults can threaten fiscal stability and institutions like the extended family, and the incessant reminders of an untimely death can seize society with a pessimism that hinders provision for the future.

Motivated by the character of the AIDS epidemic, the object of this paper is to analyze the transmission of human capital between generations when premature adult mortality is substantial, either permanently or in the form of a long wave that follows the outbreak of an epidemic. The framework is also applicable to tuberculosis, whose incidence is closely connected to that of AIDS and which accounts for a large part of the so-called burden of disease in poor countries. The basic elements are as follows. Parents have preferences over current consumption and the level of human capital attained by their children, whereby the latter is subject to the risk that the children will die upon reaching adulthood. The decision about how much to invest in the children's education, rather than putting them to work, is influenced by premature adult mortality in two ways. First, the family's lifetime income depends on the adults' health status and longevity. Second, the expected payoff to education depends on the level of premature adult mortality in the future. An increase in such mortality may result in a progressive collapse of human capital and productivity, depending on how sharp it is, how long it is sustained and how expectations about its level are formed. Conversely, sustained reductions therein may so promote the accumulation of human capital as to yield an escape from general poverty.

An increase in premature adult mortality will exacerbate inequality in nuclear family systems if orphaned children are not given the care and education enjoyed by those with parents. This selective weakening of the inter-generational transmission mechanism will also express itself in increasing inequality among the next generation of adults and the families they form. An alternative form of social organization is the extended family, in which surviving adults take in related orphans. We show that such a pooling arrangement puts the society on a “make or break” road in the following sense. It can lead to a progressive, general collapse in levels of human capital if the epidemic causes sufficiently high mortality. In less lethal disease environments, however, this form of social organization can fend off a shock that would induce a slow collapse under a nuclear family structure lacking any insurance arrangements.

This paper is related to various strands in the literature. First, there is the general empirical observation that good health has a positive and statistically significant effect on aggregate output (Barro and Sala-I-Martin, 1995; Bloom and Canning, 2000; Bloom et al., 2001). The report of the Commission on Macroeconomics and Health (WHO, 2001) also stresses that widespread diseases are a formidable barrier to economic growth.

Second, there are studies of the macroeconomic effects of AIDS, with various points of emphasis. In our overlapping generations model, higher mortality hinders the formation of human capital through three channels: first, if one or both parents die early, their children will have less productive capacity, as less human capital is transmitted; second, the loss of income due to early death in a family may reduce schooling; third, the chance that the children themselves will die prematurely as adults makes investment in their education less attractive. Corrigan et al. (2004, 2005) consider only the first two channels, but they allow for effects on the accumulation of physical capital, which has no place in our model. In a notable contribution on the severe epidemic in South Africa, Young (2005) uses a Solovian model to estimate its impact on living standards through its effects on schooling and fertility, with a constant savings rate. The chief finding is that the reduction in labor supply heavily outweighs the damage done to human capital accumulation, so that using per capita GDP as the yardstick, the epidemic is a boon to the survivors and succeeding cohorts. Johansson (2007) investigates the medium-term fiscal implications of this epidemic, also within a Solovian framework. An anti-retroviral program is largely self-financing, but the optimal policy entails an increase in government debt during the peak phase of the epidemic. Bell et al. (2006) apply the pooling variant in Section 7 below and conclude that, in the absence of intervention or drastic changes in individuals' behavior, the epidemic will be highly damaging to growth. These effects can be largely averted by suitable policies, which impose a fiscal burden of about 4% of GDP at the outset, declining thereafter.

There are also theoretical contributions with a close bearing on the present topic. In Boucekkine and Laffargue's (2010) two-period framework, an epidemic expresses itself as a rise in mortality among adults in the first period, with two opposing effects. The proportion of young adults with low human capital in the second period decreases because the survival rate of children at the end of the first decreases more among poor than wealthy families. Against this, the number of orphans increases in *all* families in the first period. Thus, the proportion of young adults with low human capital in the second period will increase if orphans are poorly educated. Chakraborty (2004) places endogenous mortality at center-stage, also in an OLG setting. Better health promotes growth by improving longevity, and investment in health emerges as a prerequisite for sustained growth.

A third strand is the literature on economic growth in which the transition through different regimes arises endogenously. Galor and Weil (1999, 2000) describe, within a unified framework, long-run development processes from an epoch of Malthusian stagnation to a state of sustained economic growth in modern times. Lagerlöf (2003) examines long-run development in Western Europe, with particular attention to epidemic shocks that affect child mortality. He shows that a series of such mild shocks caused a transition from a Malthusian stage to the industrial revolution. Population expanded less rapidly than it would have done otherwise, thereby promoting the formation of human capital and increasing productivity.