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A stochastic model of mortality, fertility, and human capital investment

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Abstract

This paper examines the relationship between fertility and human capital investment and its implications for economic growth, focusing on the effects of declining mortality. Unlike the existing literature, this paper stresses the role of uncertainty about the number of surviving children. If the marginal utility of a surviving child is convex, then there will be a precautionary demand for children. As the mortality rate and thus, uncertainty fall, this demand decreases. Furthermore, lower mortality encourages educational investment in children. The key result is that this empirically observed quality–quantity trade-off is realized only if uncertainty is incorporated into individual's optimization problem.

JEL classification: O40; I12; J11; J13
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1. Introduction

Three major developments of the past century are the declines in mortality and fertility rates and the growth of educational investment. These events have occurred both

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in the developed countries and in the developing countries.[1] The relationship between these three phenomena has nontrivial implications for economic growth.

Since increased life span implies a higher rate of return, declining child and youth mortality provides an important incentive to increase investment in the education of each child. Numerous researchers have emphasized that human capital accumulation is the prime engine for economic growth. They have not, however, rigorously investigated this particular mechanism through which increased survival chances promote growth by raising the human capital investment.

Historical and contemporary data show that mortality decline preceded the fertility decline in general.[2] As a result, countries have experienced a phase of increasing population growth rates followed by a phase of declining rates. This whole phenomenon is known as "demographic transition" and has important implications for the process of economic growth. Lucas (2002) argues that demographic transition and industrial revolution are linked events and what is new about 1800 is not technological change by itself but the fact that fertility increases no longer translated improvements in technology into increases in population. Therefore, understanding the causes of the fertility transition is crucial in terms of past, present, and future economic growth.

One explanation of the fertility transition is the reduction in infant and child mortality.[3] Previous literature models causality running from mortality to fertility as follows: if

[1] Although the likelihood of survival for all ages increased tremendously between 1780 and 1990, the most significant reduction in mortality was realized at infancy and childhood. In 1780, in Sweden, a newborn child had a 60% chance of living to age 20. By 1930, this figure had risen to 90%. Infant and child mortality fell approximately 60% between 1950 and 1990 in less developed regions (LDCs) of the world. In developed countries, fertility decline, which began by the end of the 19th century, was completed by World War II. During this period, the total fertility rate (TFR) declined from 5 children to 2.5 children. In the developing world, the fertility transition started around the 1950s, and over the past 40 years, TFR declined from 6 children to 3 children. The average number of years of schooling in England rose from 2.3 for the cohorts born between 1801 and 1805 to 9.1 for the cohorts born between 1897 and 1906. It rose even further to 14 for the 1974–1992 cohorts. In LDCs, gross secondary school enrollment increased from 17.1% in 1960 to 46.9% in 1990. See Livi-Bacci (1997), United Nations (1999), and Matthews et al. (1982).

[2] France is an exception, where fertility decline began early in the 19th century before the mortality had declined. The US also has declining fertility early in the 19th century.

[3] The other explanations of the fertility transition include the following. Becker (1981) proposes that parents decrease their fertility because of the increased opportunity cost of children due to higher wages given the assumption that substitution effect dominates at higher levels of income. Caldwell (1976) claims the decline for the need of old-age support from children as a result of development and modernization caused fertility to decline. Galor and Weil (1999, 2000) argue that as a result of increased technological progress, the returns to education increases, causing a quality–quantity trade-off and hence, a fertility transition. In another paper, Galor and Weil (1996) argue that higher wages for women raise the cost of children relatively more than they raise household income and lead to a reduction in the number of children that couples choose to have. Becker and Barro (1988) say the decline in fertility is a result of the aggregate consumption growth, and Becker et al. (1990) claim fertility declined due to the increase in the aggregate level of human capital. Azariadis and Drazen (1991), Brezis (2001), and Dahan and Tsiddon (1998) use the change in the structure of the economy, the role of the social classes, and the effect of income inequality as explanations for the fertility transition, respectively. For the developing countries, the dissemination of birth control methods is also proposed as an explanation for the decline in fertility. However, studies found that family planning programs explain only 10–40% of the decline in fertility in developing countries, and the rest of the decline is explained by the changes in desired fertility, i.e., number of children families wanted to have (Weil, 2001). Which of these explanations, including mortality decline, can explain a bigger fraction of the decline in fertility is still an open empirical question.