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Population growth in a model of economic growth with human capital accumulation and horizontal R&D

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Abstract

This paper reconsiders the effects of population growth on per-capita income growth within a Romerian (1990)-type endogenous growth model with human capital accumulation. One important novelty of our contribution is that in the human capital supply equation we explicitly consider the possibility that agents' investment in skill acquisition might be positively, negatively or not influenced at all by technological progress. We find that both the growth rate and the level of real per-capita income are independent of population size. Moreover, the population growth may affect or not real per-capita income growth depending on the size of the degree of altruism of agents towards future generations and on the nature of technical progress, for given agents' degree of altruism.

JEL classification: J10; J24; O31; O33; O41

Keywords: Horizontal differentiation; Technological change; Population growth; Human capital; Endogenous growth; Scale effects

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1. Introduction

Today it is well known that most of the world population growth is concentrated in poorer countries (United Nations, 2001) and that such trend will persist even in the long run. The latter fact is especially evident if one looks at the evolution over one century of the share of the world population living in three different sub-samples of countries (*more developed*, *less developed* and *least developed*, according to the repartition adopted by the United Nations): in the period 1950–2050 the share of world population residing in the more developed regions is expected to decrease (from 32% to 13%), whereas it is expected to increase in the less developed and, in particular, in the least developed regions (respectively, from 60% to 67% and from 8% to 20%).[1] Thus, a natural concern arising from these data pertains to the long-run effects of population change on the economic performance of a country (the growth rate of real per-capita income of its inhabitants).

Until now, the literature has proposed three broad approaches to the analysis of this deep-rooted issue (see Bloom et al., 2003, pp. 1–20). According to the *Pessimistic View*, population growth unambiguously hinders economic growth through two different channels: (a) in a world where economic resources are fixed and technological progress is low or totally absent, the food production activity is overwhelmed by the pressures of a rapidly growing population. The available diet would then fall below the subsistence level and so would the productivity growth rate also do (Malthus, 1798); (b) when population growth is rapid, a large part of investment (typically in physical capital) is used to satisfy the needs of the growing population ("*investment-diversion effect*" – Kelley, 1988, p. 1699), rather than to increase the level of per-capita capital endowments. As a consequence, per-capita economic growth would be lower in the presence of a higher population growth rate. As per the *Optimistic View*, the population growth fuels economic growth. This is the main message coming from Kuznets (1960, 1967), Simon (1981), Boserup (1989), Kremer (1993), according to whom larger economies can more easily build on, exploit and disseminate the flow of knowledge they produce. In other words, population growth by raising the returns to innovation induces technological change, one of the main engines of economic development. More recent contributions in the optimistic view also include Jones (2001a), Tamura (2002, 2006). Jones (2001a), Tamura (2006) extend the Kremer's (1993) model by introducing mortality. In both models, fertility depends positively on the level of mortality. However, they differ in two important respects. While in Jones (2001a) mortality, and hence fertility, falls because of rising levels of consumption in the population, in Tamura (2006) what makes the mortality risk decline is the increase in the average level of human capital in the population.[2] Moreover, in Jones (2001a) acceleration of economic growth comes not only from rising population (as in Kremer, 1993) but also from an exogenous increase in the productivity of population in producing ideas, whereas in Tamura (2006) higher economic growth is ultimately driven by the larger level of human capital accumulation due to falling fertility. Tamura (2002), instead, presents a model of economic and population growth able to generate endogenously a transition

[1] See United Nations (2001) and Bloom et al. (2003), Fig. 1.1, p. 13. For a broad picture of the major present and future global demographic changes and their possible effects on countries' macroeconomic performance see also Bloom and Canning (2004).

[2] Tamura (2006, p. 32) also provides convincing reasons as to why reductions in young adult mortality risk can be achieved through increases in human capital, at the aggregate as well as the individual level.