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The effects of age structure on economic growth: An application of probabilistic forecasting to India

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Abstract

During recent years there has been an increasing awareness of the explanatory power of population age structure variables in economic growth regressions. We estimate a new cross-country regression model of the effects of age structure change on economic growth. We use the new model and recent probabilistic demographic forecasts for India to derive the uncertainty of predicted economic growth rates caused by the uncertainty in demographic developments.

Keywords: Age structure; Economic growth; Probabilistic forecasting

1. Introduction

During recent years there has been an increasing awareness of a direct influence of population age structure on the macroeconomy. The theoretical foundations of the reduced form models applied in econometric studies are: (1) the life cycle model of savings and investment and (2) age specific variations in labor productivity. Recently, Bloom, Canning, and Sevilla (2003b) argued that a falling youth dependency ratio (the population below working age divided by the population of working age) contributed to the economic growth miracle in East Asia (see also, among others, Mason, 2001). More generally, the recent evidence suggests that falling youth dependency ratios in developing countries can create an opportunity for economic growth. Bloom, Canning, and Malaney (2001), Bloom and Williamson (1998), Crenshaw, Ameen, and Christenson (1997), and Kelley and Schmidt (1995, 2001) provide empirical support for this claim by finding a positive and significant effect of declining youth dependency ratios on economic growth in cross-country regressions applied to developing and developed countries. Significant age structure effects have also been found for economic growth, inflation and savings in OECD countries (Lindh, 1999; Lindh & Malmberg, 1999; Malmberg, 1994).

Except in the work of Bloom and Williamson (1998) and Lindh (1999), the implications of this evidence have not yet been discussed. Lindh (1999) presents evidence that statistical models of inflation and GDP growth

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explained mainly by the share of 5-year age groups perform well in out-of-sample projections on a horizon of 3–5 years ahead during the 1990s. A different methodology is used in Bloom and Williamson (1998). The authors used the estimated coefficients of population growth rates and growth rates of the economically active population (15–64 age group) — as estimated by a cross-county regression of economic growth applied to 78 developing and developed countries — to assess the past (1965–1990) and project the future (1990–2025) contribution of demographic change to economic growth. Their results indicate "that population dynamics can explain between 1.37 and 1.87 percentage points of growth in GDP per capita in East Asia, or as much as one–third of the miracle…" (p. 441, where "the miracle" refers to the 6% growth rate of GDP per capita observed 1965–1990 in East Asia). To make their projections, the authors combine the estimated coefficients of the population variable with the medium variant of the UN population forecasts. Their results indicate that "in East Asia, the growth in GDP per capita attributable to demographic influences is projected to be negative between 1990 and 2025,…a loss of 0.14 to 0.44 percentage points up to 2025". On the other hand, countries in South Asia are projected to gain from their demographic changes in the future.

We follow Bloom and Williamson (1998) here, and project economic growth in developing countries by combining the estimated coefficients of a regression analysis of economic growth with population forecasts. The contribution of this paper lies both in estimating a new cross-country regression model, and in our use of probabilistic population forecasts instead of deterministic ones.

We use India as a case study for our approach. India is a country for which probabilistic population forecasts are available (see Lutz & Scherbov, 2004). In addition, India is an ideal country for our purpose since it has not yet had the dramatic fall in youth dependency (which we observe for many of the Asian countries), and will not have a very dramatic increase in the elderly dependency ratio until after 2030 (Dyson, Cassen, & Visaria, 2004). Hence, falling youth dependency is particularly relevant for India's future over the next three decades. Since our sample contains mostly developing countries, the elderly dependency ratio does not vary enough in our sample for us to estimate the effect of a rising elderly dependency ratio. However, this does not matter, and again makes India a perfect choice for our forecasts. Recently, a survey of India in The Economist (2004, p.13) argued: "The most fundamental long-term reason for optimism is demographic." This paper provides a partial test of this statement.

The structure of the paper is as follows. In the next section we discuss the role of demographic variables in explaining economic growth. In Section 3 we review recent applications of probabilistic demographic projections in economics. The results of a new cross-country regression of economic growth applied to both developing and developed countries are shown in Section 4. Section 5 combines the probabilistic demographic forecasts for India with the estimates obtained from the growth regression. The final section concludes.

2. The role of demographic variables in explaining economic growth

According to the neoclassical growth model, population growth reduces economic growth due to capital dilution. Based on these theoretical arguments, the benefits of fertility control have been discussed extensively in the literature, keeping in mind the negative effect of fertility on population growth. However, various studies using cross-country data have found an insignificant effect of population growth on economic growth. Recently, Bloom and Williamson (1998) challenged this result (see also Bloom et al., 2001). They confirm that population growth has no robust effect on economic growth in growth equations where the growth rate of the total population is the only demographic variable. However, they show that demography does matter for economic growth, once one considers changes in the age structure of the population, that is, once one drops the implicit assumption of a constant age composition of the population. More specifically, the authors regress the growth rate of GDP per capita on the growth rate of the working age population and the growth rate of the total population (and various other control variables). The results show a positive and significant effect on the growth of GDP per capita due to the growth of the working age population, and an opposite, negative and significant effect from the growth rate of the total population.

Since World War II, developing countries have been undergoing demographic transitions at varying rates and times (Lee, 2003). In the standard demographic