Education, Fertility Decline, and Climate Change in India

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Abstract

Education is a major catalyst for human development, and regarded as the key to ensuring environmental sustainability. Existing studies suggest that education and family planning services correlate with each other in affecting fertility and population growth and composition which has important implications on climate change mitigation options and adaptation responses. The paper uses the IIASA multistate human capital projection model to simulate the Indian population growth under different education scenarios, and compare the outputs with the results of population projections under the scenarios of preventing unwanted fertility of Indian women through providing family planning and reproductive health services. Based on statistical analysis of national household survey data, we explore the different income and consumption patterns among Indian population by different education categories and by other demographic characteristics, such as age and household size. Adopting the NCAR integrated assessment model PET and use the results from previous two parts as input, we simulate future energy consumptions and carbon emissions under different education scenarios and decompose the overall effects of education in India on emissions into the impacts through affecting population growth, economic growth, or consumption preferences.

Extent Abstract:

Education is a major catalyst for human development, and regarded as the key to achieving Millennium Development Goals (MDG), including ensuring environmental sustainability. Many Asian countries (e.g. Singapore and Korea) are the models in achieving substantial progress in mass educations, while they have been experiencing rapid and profound socioeconomic and demographic transitions. Some other countries (e.g. India) have also gained tremendous economic growth, but not yet observed as big a change in the education systems. It is important to understand in the process how the changes in education system contributed to the demographic transition and economic growth in the Asian regions, and what the impacts of anticipated further investment in education in the regions will have on the environment and the climate system in the coming decades.
There have been some extensive discussions in the literature on the relationships between education and fertility. Female education, particularly completion of primary school and into secondary school, has emerged as strongly related to lowered fertility (Lesthaeghe et al., 1985; Jain and Nag, 1986; Jejeebhoy, 1995; Martin, 1995; Diamond, Newby and Varle, 1999; Bongaarts, 2003; Rutstein, 2003). Hannum and Buchmann (2003: 20) find that “the populations of countries with more educated citizens tend to grow more slowly, as educated people are able to lower their fertility.” Cohen, Bloom, and Malin (2006) and Rehani (2006) also cite a range of benefits of secondary education in the developing world, including lowering fertility and population growth. Lloyd, Kaufman and Hewett (2000; 510) found that almost all Sub-Saharan African countries that have achieved mass schooling also show evidence of having entered the fertility transition. While variations have been found, for example, by Cochrane (1979) that small amounts of education can result in higher levels of fertility, leading to an inverted U shape relationship, and that the relationship varies across countries and within educational groups (Hermalin and Mason, 1980), generally, higher levels of education are associated with lower levels of fertility, to the point that Carr (2000) asked if education is the best contraceptive?

Therefore, advances in education may have induced the changes in women’s reproductive value and behavior, and contributed to the fertility decline in the Asian countries. However, the past decades was also the period when family planning program was introduced in these Asian countries, which must have very likely played an equally (if not more) important role for the rapid demographic transition. It is important to know how the changes in education vs the implementation of family planning program had driven down the fertility rate, and/or whether both the factors did work jointly to trigger the demographic transition.

The studies of some scholars have suggested that family planning services and education correlated with each other in affecting fertility. Martin (1995) assessed the relationship between female education and wanted fertility in 26 DHS (Demographic and Healthy Survey) surveys and found that more highly educated women did tend to have lower fertility desires, but that “[U]nequal implementation of fertility goals by means of contraceptive use appears to be a major factor behind observed differentials” (p. 194). Bongaarts (2003) also found that “(unwanted fertility among women with no schooling is still much lower than it would have been in the absence of birth control)” (p. 331), although there is a general trend that unwanted fertility is lowest among women with higher levels of education. Moursund and Kravdal (2003), and Diamond, Newby and Varle (1999) found that the strength of the family planning program affects the relationship between education and fertility. In countries with a moderate to strong family planning program, modest levels of education were associated with substantially lower fertility, whereas in countries with weak or nonexistent family planning programs, fertility rates
of women with a few years of education were often found to be higher than that of women with no education.

The findings from these studies suggest that, while they both might have contributed to the demographic transitions in these Asian countries, improving education attainment and family planning services in the past decades may have reinforced and/or amplified each other’s effects on the fertility decline. Therefore, it becomes unclear about the net effects of education on fertility decline and the relative significance of them comparing to the effects of family planning programs. In addition to the direct effects on fertility, significant improvement in education attainment in these Asian countries could also have indirectly contributed to demographic transition through reducing mortality and increasing costs of child schooling.

Moreover, changes in population size and age structures due to education, together with other factors, have contributed to the rapid economic growth in many parts of Asia (Bloom, Canning, and Malaney, 2001), although income growth through enhancing human capital by education has no significant impact on fertility (Hazledine and Moreland 1977). One the one hand, the rapid economic growth due to changes in population age structure and human capital have generated growing demand on energy and other resources and caused increasing emissions of wastes to the environment. On the other hand, fertility decline and slower population growth due to education changes may help to ease human pressures on the environment and the climate system. In addition, individuals with various education levels may differ in consumptive preferences; shifts in education composition of a population will affect its overall consumption of energy and other resources, and lead to higher (or lower) GHGs emissions. And, the impacts of education on energy consumption and GHG emissions may vary in different stages of demographic transitions and industrialization.

Therefore, to assess the effects of investment in education on the demographic and economic transition in the past and on the potential carbon emissions and climate changes in the future, one need to consider the complicated interactions between demographic, economic, technological changes that may have triggered by the investment in education. And, the assessment should be carried out by also analyzing its comparative advantage over or co-benefits with other type of investments, e.g. promoting family planning and reproductive health services, and accounting for its multiple effects (positive vs. negative) on different aspects (e.g. climate change mitigation vs. adaptation) over various time horizons (short vs. long term).

Although the existing publications have looked at the relationships between changes in education and other factors (e.g. population growth or economic growth), there are few studies
systematically investigate the compound effects of education linking with all the important factors, due to the complexity of interactions between these factors. Moreover, there has no published study yet specifically devoted to exploring the overall effects of education attainment on environment and climate changes. The unresolved myth is one of the typical research questions for social scientists that are unlikely to be answered through well designed experiments in a real population, though it is commonly used in studies of natural sciences. Due to the lack of empirical data, it could hardly be answered either through statistical analysis of historical records, even if the statistical models could be comprehensive and intend to account for all the factors that are relevant.

In social sciences, however, one solution to these research problems is to use simulation models designed to assess the complicated interactions of important components of the system, reaching out from the baseline into the future, through conducting sensitive analysis under different scenarios. This is the approach that we adopt for the current research.

This paper, using India as an example, aims to investigate the effects of investment in education on carbon emissions and climate change. The analysis is based on the quantitative assessments conducted in two steps, in order to answer two separated but connected questions. In the first step, we investigated the impacts of education on fertility and population growth, comparing to the effects of investment in promoting reproductive health. In the second step, we simulate the effects of education on economic growth, energy consumption and carbon emissions, in order to find out whether investment in education contributes to more or less carbon emissions.

The rest of the paper is divided into three parts: (1) Use the IIASA multistate human capital projection model to simulate the Indian population growth under different education scenarios, and compare the outputs with the results of population projections under the scenarios of preventing unwanted fertility of Indian women through providing family planning and reproductive health services; (2) Based on statistical analysis of national household survey data, explore the different income and consumption patterns among population by different education categories and by other demographic characteristics, such as age and household size; (3) Adopt the NCAR integrated assessment model PET and use the results from previous two parts as input to simulate future energy consumptions and carbon emissions under different education scenarios; and decompose the overall effects of education on emissions into the impacts through affecting population growth, economic growth, or consumption preferences. Conclusions and discussions are included in the final section.

References:


