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Effects of male and female education on economic growth: Some evidence from Asia

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ABSTRACT

We use extreme bounds analysis (EBA) to examine the comparative growth effects of gender disaggregated and level-specific enrolment ratios in a panel of Asian economies. To test our hypotheses, we employ both endogenous and exogenous growth frameworks. The externality effects of education are positive and robust for both males and females and are relatively large and significant at primary, secondary and tertiary levels. The results are suggestive of a gender productivity gap. Asian economies can grow faster by investing more in female education.

1. Introduction

This paper examines the long run growth effects of education using a panel of eighteen Asian countries over the period 1970–2009. The economic benefit of improving education for all is significant, as a more educated society translates into higher rates of economic growth. This is evidenced by the large literature that has emerged on education and economic growth: see Mankiw, Romer, and Weil (1992), Barro (1991), Hanushek (1995), Temple (2000), Krueger and Lindahl (2001), Gemmel (1996), Benhabib and Spiegel (1994) and Dowrick (1995) among others.

Given the current emphasis on education by the United Nations, and the second Millennium Development Goal (MDG) of achieving education for all by increasing enrolment ratios, this study takes a gender-disaggregated and level-specific approach, empirically investigating the effects of male and female education, as measured by primary, secondary and tertiary enrolment ratios, on economic growth. Due to the renewed efforts made by the Asian economies to increase

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enrolment ratios and allocate resources efficiently in an effort to achieve the MDG of education for all, the present study focuses on Asia. The main differences between this study and a number of previous studies in the literature are as follows. We extend an endogenous growth framework based on congestion effects to accommodate gender-specific enrolment ratios and use an augmented version of the Solow (1956) model to estimate the impact of male and female enrolment at primary, secondary and tertiary educational levels on economic growth. Second, we use the extreme bounds analysis (EBA) of Leamer (1985) and its variants to identify and estimate the gender-disaggregated growth effects of male and female enrolment at different levels of education. The EBA is especially useful when there are several potential explanatory variables and it is necessary to select a few robust explanatory variables. Additionally, estimates based on the EBA reduce model uncertainty and are claimed to be robust (Leamer, 1985).

There are very few studies which examine the effects of education on growth at a gender disaggregated level; see Schultz (1993), Knowles, Lorgelly, and Dorian (2002), Klasen (2002), and Dollar and Gatti (1999). In particular, educating girls increases a country's stock of human capital and growth (Dollar & Gatti, 1999; Klasen, 2002; Knowles et al., 2002; Schultz, 1993). Educating females, just as with males, directly increases the stock of human capital and income, and promotes growth. However, there is a further benefit in educating girls because of the positive influence of mothers on the education and health of their children (Schultz, 2002). Therefore, the emphasis of this paper is on examining the gender-disaggregated effects of education on growth.

The structure of this paper is as follows. Section 2 reviews the literature on education and economic growth; Section 3 discusses the methodology; Section 4 presents the empirical results; and Section 5 concludes.

2. Review of the literature

Many studies using enrolment ratios have found a positive relationship between primary and secondary education and economic growth: see Barro (1991), Gemmel (1996) and Durlauf and Johnson (1995).

Studies which use disaggregated levels of schooling find that primary and secondary enrolments generally have a positive effect on economic growth, as opposed to tertiary education. Self and Grabowski (2004), in a study of India, find evidence of a strong causal relationship between economic growth and primary education, weak evidence of a relationship between growth and secondary education, and no relationship at all between growth and tertiary education. Petrakis and Stamatakis (2002) similarly argue that primary and secondary education contribute significantly to growth in developing nations, while tertiary education contributes significantly to growth in OECD developed market economies. Similar conclusions are reached by Pereira and St Aubyn (2009), who indicate that education at both the primary and secondary levels has a positive effect on economic growth in Portugal: however, tertiary education does not contribute significantly to economic growth. de Meulemeester and Rochat (1995) also find evidence of a relationship between education and growth, though only for some countries in the sample investigated. They argue that education can promote growth only if the curriculum is designed with the needs of the economic system in mind.

Studies which disaggregate enrolment by gender find mixed evidence with respect to growth. Barro and Sala-I-Martin (1995) find that male education is positively related to growth while female education is negatively related to growth. Barro (2001) subsequently finds that female primary education is positively related to growth while male secondary and tertiary education enrolments are positively related to growth. Self and Grabowski (2004), on the contrary, show that female education has the potential to increase economic growth, as compared to male education.

3. Methodology

Romer (1986) shows that externalities generated by the education sector can raise labour productivity further, across the whole economy. Our analytical framework is a generalisation of the approach of Lau and Sin (1997a, 1997b) where a special form of Romer's (1986) production function is used to assess the impact of externalities of public investment for a closed economy, as follows:

$$y_{jt} = Ak_{jt}^{\alpha}[(1+\gamma)^{t}l_{jt}]^{1-\alpha}\tilde{K}_t^{\lambda}\tilde{S}_t^{\theta}\varepsilon_t^{p} \tag{1}$$

where $0 \leq \alpha, \lambda, \theta < 1$ and y_{jt}, k_{jt}, and l_{jt} are the output, physical capital and labour inputs of agent j at time t and K_t and S_t are congestion adjusted to be defined later as private and public capital available to all agents at time t. The Harrod-neutral rate of technical progress is denoted by γ. This type of production function can accommodate both neoclassical and endogenous growth models in one framework through the parameter γ. The production function represents constant returns to scale with respect to capital and labour inputs of a representative agent. In addition, the congestion-adjusted private and public capitals are external inputs in an agent's production function, creating spillover effects. The parameters λ and θ represent these externality effects.

Ganegodage and Rambaldi (2011) extend the above Lau and Sin (1997a, 1997b) framework by further decomposing the public capital component S_t. In this paper we modify the Ganegodage and Rambaldi (GR) framework by disaggregating the human capital stock into level-specific male and female enrolments and elaborating the open economy assumption by