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## Growth in emerging economies: Is there a role for education?

Balint Lenkei<sup>a</sup>, Ghulam Mustafa<sup>b,\*</sup>, Michela Vecchi<sup>a,c</sup><sup>a</sup> Middlesex University Business School, The Burroughs, Hendon, NW4 4BT London, UK<sup>b</sup> Department of Economics, Forman Christian College (A Chartered University), Lahore, Pakistan<sup>c</sup> NIESR, 2 Dean Trench Street, Smith Square, W1P 3HE London, UK

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## ABSTRACT

We study the relationship between human capital and growth using a model which encompasses previous specifications and estimates the short and the long-run effects of human capital accumulation. We adopt an empirical framework which accounts for countries' heterogeneity and cross-sectional dependence in a dynamic panel. Results for a sample of 14 Asian countries reveal a large and positive long-run impact of human capital on growth in the 1960–2013 period. Looking at different types of education we find that the diffusion of primary and secondary education has a positive long-run impact, while the long-run effect of tertiary education is negative. Low proportion of people educated at the tertiary level, lack of opportunities for highly educated workers and the brain drain phenomenon could explain this result. These results support policies directed towards increasing investments in primary and secondary education rather than focusing on a minority educated at the tertiary level.

*"The experience of the developing world actually makes it all too clear that education cannot guarantee growth". (Alison Wolf, 2002)*

## 1. Introduction

In 2001 Lant Pritchett asked 'Where has all the education gone?' The question refers to the weak empirical macroeconomic evidence on the effect of investment in education on growth, which is in stark conflict with the theory and with results at the microeconomic level (Pritchett, 2001). In theory, the role of human capital on growth is indisputable. Since the seminal contributions by Becker (1964) and Schultz (1981), followed by a wave of endogenous growth models such as Lucas (1988) and Romer (1986, 1990), investments in human capital have been identified as a key policy instrument to improve productivity growth both directly, as skilled workers are more productive, and indirectly as human capital increases countries' ability to absorb new knowledge and to generate externalities (Cohen and Levinthal, 1989; Nelson and Phelps, 1966; Griffith et al., 2004; Vandenbussche et al., 2006).

While microeconomic studies have reached a consensus on the size of the effect of schooling on wages (Krueger and Lindahl, 2001),<sup>1</sup> at the

macro level the assessment of the impact of human capital (usually measured in terms of enrolment into education or educational attainment) on output growth has produced mixed results. Studies based on cross-country growth regressions have produced evidence of the positive impact of education on growth (Barro, 1991, 2001; Levine and Renelt, 1992; Mankiw et al., 1992). However, studies based on panel data have not been able to find a meaningful role for human capital in growth regressions (De Gregorio, 1992; Knight et al., 1993; Caselli et al., 1996; Hamilton and Monteagudo, 1998; Madsen et al., 2010). This outcome is surprising. In an era of fast technological development, education should be crucial in pushing the frontier forward in developed countries and in promoting the adoption of foreign technologies in emerging economies (Vandenbussche et al., 2006). Nevertheless, even for the latter, opinions are divided as to whether investments in education are worth the effort (Wolf, 2002).

This paper investigates the role of human capital on growth using an innovative analytical framework, with the main objective of bringing some resolution to the mixed evidence and shed light on some of the unresolved issues that still plague the applied macroeconomic literature. First, it is still unclear whether the accumulated stock or the growth of human capital plays the main role in accounting for growth, or whether

\* Corresponding author.

E-mail address: [ghulammustafa@fccollege.edu.pk](mailto:ghulammustafa@fccollege.edu.pk) (G. Mustafa).

<sup>1</sup> Since the seminal contribution of Mincer (1974), the Mincerian wage regression has become a yardstick to estimate the returns to education and experience. A survey of the empirical evidence concludes that the average returns to education for both developing and developed countries are about 10 percent for each additional year of education (Card, 1999).

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they should both be included in the growth equation (Sunde and Vischer, 2015). Here we adopt an Error Correction Model (ECM) representation, which controls for the long-run (accumulation effect) and short-run (growth effect) of human capital on growth. This approach also provides a more general way of specifying the role of human capital, and allows us to test directly the validity of the restrictions imposed by some of the most commonly used empirical models.

Second, the empirical analysis in this paper makes use of recently developed econometric techniques that account for cross-sectional heterogeneity and cross-sectional dependence in panel data. As discussed above, heterogeneity across countries has been frequently acknowledged in the literature and is usually addressed with the introduction of country dummies, assuming common slope coefficients (Temple, 1999; Krueger and Lindahl, 2001; Vandenbussche et al., 2006; Al-Yousif, 2008; Zhang and Zhuang, 2011). In this paper, we use a mean group estimator, while contemporaneously controlling for the presence of unobserved common factors that can create dependencies across units (Eberhardt and Presbitero, 2015; Eberhardt and Teal, 2013). Examples of such unobserved factors include global shocks, such as the recent financial crisis (Chudik et al., 2011) and the presence of spillovers (Eberhardt et al., 2013). Omitting the impact of these common factors can cause an omitted variable bias and produce inconsistent estimates.

The empirical analysis in this paper focuses on 14 Asian countries, observed over a period of 54 years (1960–2013), using data from the Penn World Table and the Conference Board. The strong economic performance of most countries in this area, together with increasing investments in education, provides an ideal setting to assess the role of human capital. Studies with a specific focus on emerging countries and with robust estimation techniques are still scarce, therefore this paper provides insights into a relatively less explored dimension of the relationship between human capital and growth. Our analysis will also answer the question of whether cross-country data can capture any effect of human capital on growth (Pritchett, 2006).

Our main human capital proxy is the average years of schooling for the population aged 15 and over (Barro and Lee, 2010). We compare results based on this measure with the educational variable in the Penn World Tables (PWT), which adjusts the Barro-Lee (BL) indicator by the assumed returns for primary, secondary and tertiary education, as in Caselli (2005). In addition, we examine how the different levels of education (primary, secondary and tertiary) affect growth. This analysis is particularly meaningful for emerging economies where a large share of the population is only educated at the primary level. Despite the imperfections of these human capital proxies (De la Fuente and Domenech, 2006; Mason et al., 2012), they have the advantage of being available for most countries and allowing comparisons with existing studies. Finally, to account for endogeneity, we adopt ARDL modelling framework which allows us to obtain consistent estimates (Pesaran and Shin, 1999).

Our results provide evidence that investments in human capital have contributed to Asian countries' economic performance over the 54 year-period. This result is robust to the use of different econometric techniques, and to the introduction of controls for cross-sectional dependence. Using our preferred specification, the long-run human capital coefficient ranges between 0.4 (using the BL measure) and 1.2 (using the PWT measure). Our study also shows that previous models used for the analysis of human capital and growth are restricted versions of an ECM specification and these restrictions are rejected in our analysis, implying that some of the results found in the related literature might be affected by an omitted variable/specification bias. When we account for different education levels, we find that the number of years of primary and secondary education have an important effect on growth, while the long-run effect of tertiary education is negative. We provide three main reasons for this result: low proportion of people educated at the tertiary level (Lau, 2010), lack of adequate job opportunities for highly educated workers, who might end up working in low-productivity sectors (Pritchett, 2001) and the brain-drain phenomenon (Beine et al., 2008).

Our paper contributes to the existing literature on the human capital –

growth nexus in three ways. First, it contributes to the debate on how to best model the impact of human capital on growth, which has a long-standing tradition in the growth literature, starting from Solow (1956) and Lucas (1988) and including Benhabib and Spiegel (1994), Temple (1999), and Sunde and Visher (2015), among others. We propose a more general modelling strategy that encompasses previous specifications, hence addressing this important debate. Second, our study offers an alternative empirical framework to the analysis of the role of human capital on growth, contributing to a discussion initiated with Islam (1995), who advocated the use of panel data as opposed to cross sectional data, and further developed in Sianesi and Van Reenen (2003) and Mason et al. (2012). To our knowledge, this is the first application of dynamic panel estimation techniques, with controls for cross-sectional dependence, to the analysis of the human capital – growth relationship. Third, we further the understanding of the role of human capital in emerging economies, where incentives to increase investments in education have been particularly strong in recent years. More specifically, by considering different levels of education, we contribute to the debate of whether resources should be directed towards the diffusion of primary and secondary education, or whether should be aimed at educating a smaller proportion of the population at the highest level (Castelló-Climent and Mukhopadhyay, 2013). Our results indicate that the first option is to be preferred.

The rest of the paper is organised as follows. In the next section we provide some background features of investments in education and growth in Asian countries, comparing their performance with the US. Section 3 introduces our analytical framework while Section 4 describes the data and the econometric framework. Section 5 presents the results of our empirical analysis and Section 6 concludes the paper.

## 2. Background

Asian countries have made large investments in education, particularly in primary and secondary education, in recent years. This has substantially reduced the proportion of the population with no schooling. The top half of Fig. 1 shows that in 1960 the proportion of the population aged 15 and over with no schooling amounted to nearly 100% in Nepal, 80% in Bangladesh and Pakistan and over 40% in most of the other countries. Lower proportions were observed in Hong Kong, Philippines, Taiwan, Thailand and Sri Lanka, but even these countries compare quite poorly next to the US, where the proportion of the population with no education was very close to zero in 1960.

The picture changes dramatically in 2010,<sup>2</sup> with a substantial drop in the proportion of the population with no schooling. Many governments have invested heavily in education since the year 2000 to achieve the Millennium Development Goals of universal primary education for all children by 2015 and this has contributed to the trend depicted in Fig. 1 (Dundar et al., 2014). Countries like Taiwan, Republic of Korea and the Philippines, which started to invest in education at an earlier stage compared to other Asian countries, caught up with the Western world's standards, while in the rest of the sample the proportion of population without schooling has more than halved between 1960 and 2010.

In Table 1 we compare the proportion of the population aged 15 and over with secondary and tertiary education in Asia and in the US, in 1960 and in 2010. All countries in Asia increased investments in secondary education over the period under consideration, catching up with the USA. Investments in tertiary education have also increased but at a much slower pace. Large differences still persist in 2010 in the proportion of the population with tertiary education, which is substantially lower in Asia compared to the US, particularly in countries like Bangladesh, Nepal and Pakistan.

The last 3 columns of Table 1 show the (logarithmic) rate of output

<sup>2</sup> The Barro & Lee data is available until 2010. In the empirical analysis we will extrapolate this variable until 2013.

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