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The composition of human capital and economic growth: Evidence from China using dynamic panel data analysis

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ABSTRACT

This study examines the effect of the composition of human capital on economic growth in China, using the Generalized Methods of Moments (GMM) method. The results show that tertiary education plays a more important role than primary and secondary education on economic growth in China. Moreover, the role of the composition of human capital on regional economic growth is relevant to the level of development. The more developed provinces benefit more from tertiary education, while underdeveloped ones depend more on primary and secondary education.

1. Introduction

Economic theory has emphasized the important role of human capital on economic growth (Denison, 1962; Lucas, 1988; Romer, 1986; Schultz, 1961). As education is one of the primary components of human capital, many growth literatures have provided a conceptual framework that links education and growth (Mankiw, Romer, & Weil, 1992; Mulligan & Sala-I-Martin, 1992). An abundance of empirical studies have found a positive relationship between growth and education (Barro, 1991; Levine & Renelt, 1992; Mankiw et al., 1992), while some recent papers have found that the relationship between changes in average schooling and growth is weak (Benhabib & Spiegel, 1994; Islam, 1995; Pritchett, 2001).

In contrast to the prior studies where human capital is typically treated as a homogeneous concept, recent papers are concerned with the significance and relevance of different types of education (tertiary, secondary and primary) to economic growth. Ramcharan (2004) developed an analytical framework which showed how the composition of human capital stock determined a country's development and concluded that average years of schooling could mask potentially important differences in the composition, which helps to understand why some empirical studies have failed to detect a significant relationship between schooling and growth. Vandenbussche, Aghion, and Meghir (2006) developed a theoretical model showing that skilled labor had a higher growth effect closer to the technological frontier.

Most of empirical literatures related to different educational levels were based on evidence provided by cross-country studies (Barro & Lee, 1997; McMahon, 1998; Petrakis & Stamatakis, 2002). Only a small set of recent papers investigated the relationship between different educational levels and growth in one country. Using time series in India, Self and Grabowski (2004) found that primary education had a strong causal impact on economic growth, with more limited evidence of such an impact for secondary

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education. Pereira and St. Aubyn (2009) concluded that increasing education at all levels except tertiary had a positive and significant effect on growth in Portugal. Although the prior studies have found the different effects of each educational level on growth, they can't figure out whether the effects are dissimilar in different regions of one country and what is the best composition of human capital in one country.

With regard to the studies of human capital in China, most of empirical literatures treated human capital as a homogeneous concept. Some papers incorporated human capital in the growth accounting and found a positive relationship between growth and education (Fleisher & Chen, 1997; H. Li & Huang, 2009; Li & Liu, 2011; Wang & Yao, 2003), while several studies which included human capital in the regressions to explain regional growth disparity in China found an insignificant effect of human capital on growth (Chen & Fleisher, 1996; Wei, Liu, Song, & Romilly, 2001). However, there are several recent papers which investigated the relationship between different educational levels and growth in China. Chi (2008) concluded that tertiary education has a positive and larger impact on GDP growth than primary and secondary education. Fleisher, Li, and Zhao (2010) found that workers with more than elementary school education have a much higher marginal product than labor with no higher than elementary schooling. Lau (2010) found that schooling at the primary level triggers economic growth, while investments in secondary and higher levels of human capital do not favor economic growth.

This paper considers the impact of the composition of human capital on China's economic growth, using China's provincial data and the growth regression framework. In order to account for the possibility of dynamics and endogeneity issues, this paper uses the Generalized Methods of Moments (GMM) method which becomes popular recently in the education and growth empirical literatures (Agiomirgianakis, Asteriou, & Monastiriotis, 2002; Chi, 2008; Gyimah-Brempong, Paddison, & Mitiku, 2006; Seetanah, 2009). A new variable is introduced, namely the human capital structure which is the percentage of human capital with tertiary education to investigate whether the human capital structure has an inverse-U-shape effect on economic growth, and what is the best composition of human capital in China. In addition, this paper also analyzes whether the effect of human capital and its structure on regional economic growth is relevant to the level of development.

The paper is organized as follows. Section 2 describes the variables used in our model and sources of data. Section 3 explains the methodology. Section 4 is the main results. Conclusions are summarized in Section 5.

2. Data and variables

This paper consists of data for 31 provinces in China over the period 1997–2006. Data on provincial GDP and physical investment are drawn from *China's economic statistics database (web)*; all other data come from the *China Statistical Yearbook (various years)*.[1] Table 1 shows the descriptive statistics of the various variables.

2.1. Gross domestic product, output gap and physical investment

We intend to investigate the relationships between economic growth and the composition of human capital with a regression analysis. The explained variable in our model is the real GDP per capita in each province.

Although the main objective is to account for long-run trends in economic growth, in practice, we work on relatively short-time periods (1997–2006, 10 years time). At these frequencies, the cyclical effects are bound to play a role. Following Loayza and Soto (2002), we account for cyclical reversion by including the output gap at the start of each period as a growth determinant. The output gap used in the regression is obtained as the difference between potential and actual GDP around the start of the period. We use the Hodrick–Prescott filter to decompose GDP and estimate annual series of potential (trend) and cyclical output for each province in the sample.

According to the neo-classical convergence model (Lucas, 1988), the rate of capital formation is an important growth factor which represents growth rates of capital accumulation. It is obtained by the amount of regional capital formation divided by gross domestic product.

2.2. Human capital

There are various variables as proxies for education in empirical research on human capital. We use average years of schooling, and denoted H to measure human capital which is generally considered a better measure than the school enrolment rate or student–teacher ratio (Chi, 2008). Due to the data available in the *China Statistical Yearbook*, we consider average years of schooling of people aged 6 and above. The schooling years of different levels of schooling in China (elementary school, junior high school, senior high school, junior college and over) are 6, 9, 12 and 15.5 years respectively. Then, the human capital stock, H, is given by

$$H = (6*L_6 + 9*L_9 + 12*L_{12} + 15.5*L_{15.5})/\text{pop} \quad (1)$$

where L_s refers to the number of persons with schooling years s and pop is the population aged 6 and above.

[1] Raw data used in this paper is available from the authors on request.