

# The role of human capital in China's economic development: Review and new evidence<sup>☆</sup>

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## Abstract

We carefully utilize empirical methods and measurement, and find that the effect of human capital on China's economic growth may be indirect through physical capital investment. This result is different than that found for OECD countries and has not been suggested by previous studies. In addition, in determining physical capital investment, workers with college education play a more significant role than those with primary and secondary education, suggesting the possibility of capital-skill complementarity. This finding has implications for China's future regional growth inequality: the inequality may increase rather than decrease, because physical capital investment continues to accumulate faster in the eastern area where the human capital stock is larger and thus leads to greater economic growth in the east. © 2007 Elsevier Inc. All rights reserved.

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## 1. Introduction

Close-to-double-digit growth in the last several decades has gained China the praise of growth miracle. Amid the acclaim, there have been some concerns. One concern is that China's economic growth is largely labor intensive, featuring high fixed capital investment and energy consumption (Arayama & Miyoshi, 2004; Chow, 1993; International Energy Agency, 2005; Yusuf, 1994).<sup>1</sup> This growth pattern faces a limit. Alternatively, growth driven by human capital has potential to be substantial and sustainable due to the increase in productivity, technological innovation and diffusion (Aghion & Howitt, 1998; Lucas, 1988; Nelson & Phelps, 1966; Romer, 1990).

Another concern is, although China achieved fast economic development, the growth rates of different regions vary notably, so that the regional development gap has not been reduced but even enlarged. The large differences across regions may be caused by different regional natural conditions, government policies, and fixed capital investment including

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<sup>1</sup> According to the IEA's estimate, to produce the same dollar amount of GDP, China uses 3 times more energy than the world's average level.

foreign direct investment. Different human capital levels across regions may also be an important contributor to regional development inequality.

Our study pertains to the two aforementioned concerns. Using provincial data from 1996 to 2004, our initial findings show an insignificant effect of human capital and a sizeable and significant effect of fixed capital investment on economic development. We also find evidence of convergence in growth rates across regions conditional on the inclusion of human capital and physical capital. These findings are consistent with empirical evidence found by previous research which suggests that China's economic growth is mostly driven by fixed capital investment and that regional development inequality is attributable to different physical capital investment amounts across regions.

However, our further analysis shows that fixed assets investment is endogenous as 84% of variation in the fixed assets investment across provinces may be explained by the provincial initial human capital stock and wealth level. Moreover, college or above level education is a more important determinant of physical capital investment decisions than primary or secondary education. After correcting for endogeneity using the two-stage least square method, we find that the effect of fixed capital investment on the growth rate is no longer significant.

These new findings have two potentially important implications: 1) human capital has already played a significant role in China's economic development in recent years, and the role of human capital may be indirect by impacting physical capital investment. 2) China's regional growth inequality may increase rather than decrease in the future. This is because eastern areas traditionally have a large stock of college-educated workers and college-educated workforce is more likely to attract physical capital investment than primary and secondary education. Thus, rather than flow to the west voluntarily, physical capital investment will continue to build up in the eastern area where the human capital stock is larger and cause the eastern area to grow faster than the central and western areas.

The rest of paper is organized as follows: in Section 2 we review previous empirical evidence regarding the role of human capital in China's economic development. Section 3 describes data and variables. Sections 4–6 presents sequentially the estimates of growth models; the impact of human capital on fixed assets investment; the 2SLS estimates; and the contribution of government and social education expenditure to workers' educational attainment. A summary and conclusion is contained in Section 8.

## 2. Literature review

China's rapid economic growth has stimulated a wide research interest and heated debate. The research and debate focus on whether China's economic growth is mainly driven by productivity growth or by capital and labor factor accumulation. Some researchers are more optimistic, showing evidence of a clear improvement of total factor productivity (TFP) in the post-reform period of China, and also finding that the increase in TFP has made a substantial contribution to economic growth. Specifically, the increase in TFP contributes 40% to GDP growth, roughly the same as that contributed by fixed assets investment (Borensztein & Ostry, 1996; Hu & Khan, 1997; Jefferson, Rawski, & Zheng, 1992; Yusuf, 1994). Other researchers conclude more pessimistically that economic growth in China is still mostly driven by capital investment (Chow & Lin, 2002; Woo, 1998; Wu, 2003). For example, Chow and Lin (2002) showed that the increase in TFP contributed 29% to GDP growth during 1978 to 1998, compared to a 62% contribution by capital.

Compared to capital investment and TFP, the increase in labor has generally been found as a less important growth factor. Recent research shows that 10–20% of GDP growth may be attributable to the growth of labor force (Chow & Lin, 2002; Hu & Khan, 1997; Woo, 1998; Wu, 2003). Despite the importance of the question, whether and how human capital contributes to fast economic growth in China has not been examined thoroughly. Relatively few empirical studies have included human capital as a growth factor in addition to labor. Among the few exceptions are Wang and Yao (2003) who constructed a measure of the stock of human capital and incorporated it in the growth accounting. They found that capital, labor, human capital, and TFP each accounted for 48, 16, 11, and 25% of GDP growth during the period 1978–1999. Fleisher and Chen (1997) examined the impact of human capital on TFP with human capital measured by the percentage of university graduates in the population, and found that human capital had a significant effect on TFP. Other than Wang and Yao (2003) and Fleisher and Chen (1997), several studies have included human capital in the regressions to explain regional growth disparity in China. However, since these studies focus on assessing whether the growth rates of different regions converged or not, they have not investigated the role of human capital thoroughly. Table 1 shows the list of these studies.

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