Human capital, economic growth, and regional inequality in China ☆

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ABSTRACT

We show how regional growth patterns in China depend on regional differences in physical, human, and infrastructure capital as well as on differences in foreign direct investment (FDI) flows. We also evaluate the impact of market reforms, especially the reforms that followed Deng Xiaoping's "South Trip" in 1992 those that resulted from serious hardening of budget constraints of state enterprises around 1997. We find that FDI had a much larger effect on TFP growth before 1994 than after, and we attribute this to the encouragement of and increasing success of private and quasi-private enterprises. We find that human capital positively affects output and productivity growth in our cross-provincial study. Moreover, we find both direct and indirect effects of human capital on TFP growth. These impacts of education are more consistent than those found in cross-national studies. The direct effect is hypothesized to come from domestic innovation activities, while the indirect impact is a spillover effect of human capital on TFP growth. We conduct cost-benefit analysis of hypothetical investments in human capital and infrastructure. We find that, while investment in infrastructure generates higher returns in the developed, eastern regions than in the interior, investing in human capital generates slightly higher or comparable returns in the interior regions. We conclude that human capital investment in less-developed areas is justified on efficiency grounds and because it contributes to a reduction in regional inequality.

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1. Introduction

This paper reports research on the effects of human capital, infrastructure capital, and foreign direct investment (FDI) on regional inequality and economic growth in China. China's dramatic economic growth since the beginning of economic reform in 1978 has been very uneven across regions. We investigate these related trends for two reasons: (i) to understand their causes; (ii) to derive implications for policies to harness the causes of growth to reduce inequality in other countries. We model two roles for human capital: (i) educated workers embody human capital that contributes directly to output in the production process itself; (ii) human capital, particularly that represented by higher education, plays an important role in total factor productivity (TFP) growth. Infrastructure capital is hypothesized to affect GDP through TFP growth, as is FDI.

We specify and estimate a provincial aggregate production function in which inputs are specified to include physical capital and two categories of labor: (i) less-educated workers, those who have no junior high school education and (ii) educated workers, those who have some junior high school education or above. The estimated output elasticities of the three inputs are used to calculate factor marginal products and also TFP at existing provincial factor quantities. We then estimate a TFP growth model in which the arguments are human capital operating directly and through regional technology spillovers, infrastructure capital, physical-capital vintage effects, foreign direct investment, and marketization. FDI is treated as an endogenous variable.

We derive three sets of hypothetical policy implications from our empirical results. (1) We use our estimated production function parameters to calculate marginal products of labor and capital and then project how the reallocation of labor to equalize marginal products across regions would affect per capita GDP and the number of workers in each region. (2) We project results of another reallocation scenario—the impact on the time path of regional GDP ratios of a tax-transfer scheme
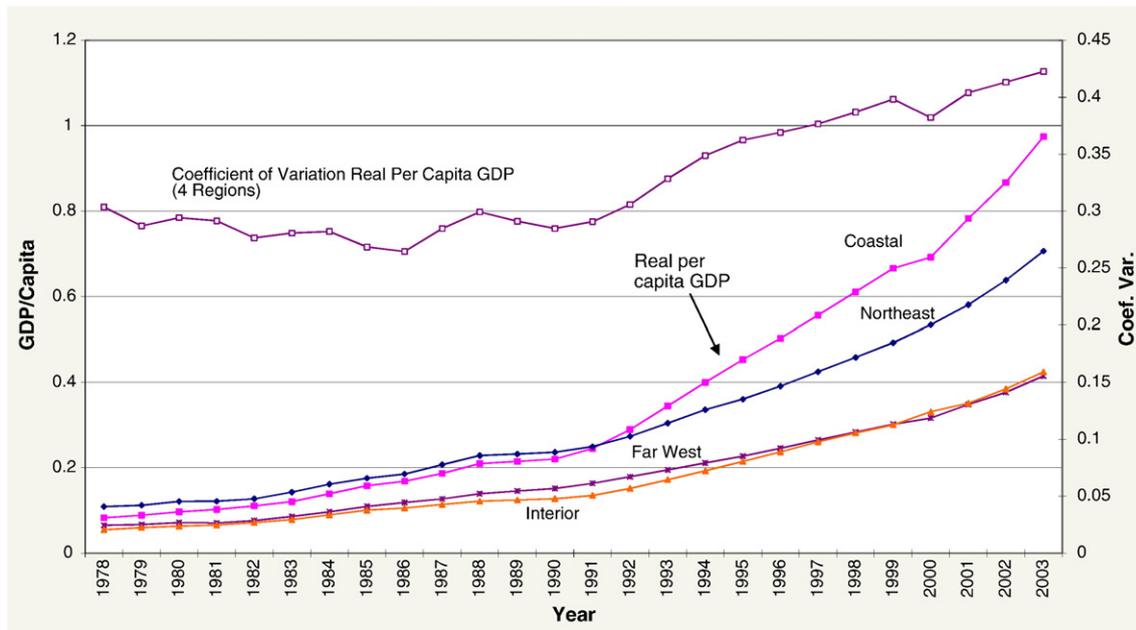
Fig. 1. Real GDP per capita (RMB 10,000 Yuan in 1990 Beijing value). Sources of data: various years of the China Statistical Yearbook and China Data Online (2008).

that would increase investment in human capital and/or infrastructure capital. (3) We calculate internal rates of return to policies that would reallocate resources to investment in infrastructure and human capital. We believe the results have important implications for an understanding of economic growth in general, for factors contributing to China's rapidly rising regional inequality, and for the design of policies that would lead to a more equitable distribution of the benefits of growth within the world's most rapidly expanding economy.

The remainder of this paper proceeds as follows. Section 2 provides some background information. In Section 3 we lay out our methodology. Section 4 describes our data. Section 5 reports our empirical results for aggregate production functions and TFP-growth models. In Section 6, we conduct cost–benefit analysis by computing the rates of return to investment in human capital and telephone infrastructure. In addition, we perform a hypothetical experiment by evaluating alternative investment strategies in reducing regional inequality. Section 7 concludes and provides policy recommendations.

2. Background

By the year 2000, China found itself with not only one of the highest rates of economic growth but also one of the highest degrees of rural–urban income inequality in the world (Yang, 2002). The rural–urban disparity feeds the wide regional economic inequality (Yang, 2002), which is a relatively new phenomenon in China's last half century. From the beginning of the Mao era through 1986, inequality across major regions (as measured by the coefficient of variation of per-capita real gross domestic product) trended downward, but it rose sharply in the decade of the 1990s (Fig. 1).[1] This trend is also apparent from regional per capita GDP shown in Fig. 1. The gap between the coastal

region and other regions has increased rapidly since 1991. Fig. 2 illustrates the rising regional inequality in China since 1978, the start of economic reform, using the ratio of per capita GDP between the three non-coastal regions and the coastal region. The industrial northeast, where per capita gross domestic product substantially exceeded that in the coastal region at the end of the Mao fell to a position 30% less than the coast by 2003. The coast's early advantage over the interior and far west soared to a ratio of approximately 2.4 by 2003. By comparison, among the major regions of the United States in 2004, the ratio of the highest to lowest regional per-capita GDP was only 1.3 (United States Bureau of Economic Analysis, current web site). In China in the year 2003, the ratio of real per-capita GDP between the wealthiest province and the poorest was 8.65, while in India for 2004, the comparable ratio (in nominal terms) was only 4.5 (Purfield, 2006).

2.1. Human capital and growth

China's investment in human capital beyond the level of secondary schooling has been small in comparison with nations at similar levels of per capita income and economic development, and its geographical dispersion has been large (Fleisher, 2005; Heckman, 2005). In 2004, the government expenditures on education were 2.79% of GDP and had been below 3% in most years since 1992, much lower than the average of 5.1% in developed countries. As shown in Table 1, the proportion of the population with some college education (including graduates and postgraduates) was 0.6% in 1982 and had risen to only 1.3% by 1992. Starting in 1999, the Chinese government increased the enrollment of college students sharply. The annual growth rate in new college enrollment between 1999 and 2003 was 26.6% (State Statistical Bureau, Various Years).[2] However, by 2003, the proportion of those with at least some college in the national population was still quite low, at 5.2%. The proportion of these individuals in the coastal, far west, and northeast regions was at least 6% in 2003, while in the interior (with nearly 52% of the national population) it was only 4.2%. The proportion of adults who had at least some senior high school education or above

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[1] The four regions defined in this study are: coastal (Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, and Guangdong-Hainan); northeast (Heilongjiang, Jilin, Liaoning), interior (Inner Mongolia, Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan-Chongqing, Guizhou, Yunnan, and Shaanxi) and far west (Gansu, Qinghai, Ningxia, and Xinjiang). We have excluded Xizang (Tibet) province due to lack of data, combined Chongqing with Sichuan and Hainan with Guangdong. The division of the four regions is based on the results of past research and our own judgment regarding the major economic and geographical clusters that characterize distinct "clubs" of economic growth and development in China.

[2] The enrollment data exclude Tibet in order to be consistent with the sample of provinces that we use in this paper.