# Determinants of economic growth in China: Private enterprise, education, and openness

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## Abstract

This essay investigates the source of cross-provincial variations of economic growth in China. A statistical analysis of data on 29 provinces, municipalities, and autonomous regions from 1978 through 1989 confirms the findings in the literature of empirical studies of economic growth based upon cross-country empirical analyses, and uncovers some characteristics unique to China. We find that private and semi-private enterprises, higher education and international trade all lead to an increase in economic growth in China. We also find that high fertility, high inflation, and the presence of state-owned enterprises (SOE) reduce growth rates among the provinces. Finally, our evidence indicates that the convergence hypothesis holds in China. © 2000 Elsevier Science Inc. All rights reserved.

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## 1. Introduction

Reform in China has resulted in unprecedented economic expansion since 1978, although its provinces evince quite different growth trajectories. The coastal area has experienced higher growth rates than the hinterland, which has enlarged income disparity between the two regions. If uncorrected, the uneven growth not only threatens the ultimate success of China's economic reform, but will also bring about serious social and political problems. Therefore, developing the economies of the inner region, so that its income can catch up with the coastal region's, is both an economic challenge and a political necessity in China.

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So what determines economic growth across the Chinese provinces? Or in other words, what explains the difference in growth among them? What are the major factors that drive high economic growth in the coastal region, and what causes the inner region to lag behind? What useful lessons about development can the inner region learn from its coastal counterpart? This study intends to address these specific questions.

In a cross-country setting, numerous theoretical and empirical studies find that growth is determined by human capital, fertility, trade, government consumption, the rule of law, political stability, income distribution, inflation and the terms of trade (e.g., Barro, 1991, 1997; Barro & Lee, 1993; Chen & Feng, 1996; Feng, 1997; Persson & Tabellini, 1992). All of these studies confirm the so-called conditional convergence of different nations; and Barro (1997) finds that the gap of income per capita between poor and rich nations narrows at a rate of 2–2.5 percent if such factors as education level and the openness of the economy are controlled.

We can infer some important policy implications for China's economic growth from these general findings. First, human capital is critical for less developed provinces to achieve high economic growth. To build human capital, the inner region not only needs to open more schools, produce better students, and improve health care provisions, but also must establish a labor system that can retain the best and brightest people.

Second, international trade is conducive to a region's growth and development. Provinces should allow resources to shift to the sectors where they have a comparative advantage. In the case that the transaction cost in foreign trade is high for interior provinces, they should engage in inter-provincial trade in order to benefit from the spillover of international trade. Restrictions to trade between provinces are detrimental to economic growth in these provinces and weaken a unified national economic identity.

Additionally, a reduction in the fertility rate can enhance economic growth. Feng et al. (2000) examine the pattern of demographic transitions in the world and in China. They show that the government can promote long-term development through implementing a population policy that favors economic growth.

The results of cross-country growth literature also point to the political role that the central government can play in improving the less-developed provinces' economic growth. First, since the widening income gap between the inner and coastal areas can lead to political instability and polarization, the Chinese central government should emphasize the importance of the inner areas' growth and development. The central government policies should not be biased in favor of the coastal region.

Second, if the central government decides to provide financial help to the inner, less developed provinces, funds should be used in ways that achieve maximum growth, such as establishing schools, improving health care, and building inter-provincial infrastructure.

Third, the central government should guarantee a unified domestic market and the free flow of goods across provinces. A fragmented domestic market is detrimental to the national economy.

Last but certainly not least, the central government needs to provide a stable macroeconomic environment conducive to sustainable growth. High and volatile inflation has a negative effect on growth.

Even though China needs to learn many lessons from the cross-country empirical studies on growth, the Chinese economy may have some unique characteristics because of

its former structure. Our casual observation suggests that a larger share of production by non-state-owned enterprises could result in higher economic growth in the coastal areas. To the extent that private and collective enterprises (mostly township and village enterprises) are more efficient and lead to higher growth, the inner region should encourage the establishment of non-state-owned enterprises. Consequently, curtailing the widening coastal-inner provincial income gap can be effectively achieved by promoting collective or private enterprises.

Also, start-up funds, credit lines, and the transfer of technological know-how to small private entrepreneurs—resources such as those provided by small business programs in the United States—can significantly reduce the coastal-inner provincial income gap. This approach can be more efficient than a transfer policy that simply redistributes income from the richer coastal to the poorer inner provinces because of learned, ongoing self-sufficiency rather than depending on a one-time cash infusion. So, instead of banking on handouts from the central government in order to catch up with the coastal regions, the provincial governments for inner regions should rely on internal systems to promote efficient private and collective enterprises.

The purpose of this research is two-fold: To identify the commonalties among China's and other countries' growth patterns, and to investigate China's unique characteristics. In this process, we make use of recently available data from the Chinese provinces to study the factors that drive economic growth across the provinces and the income convergence between the coastal and inner regions. The next section delineates the structure of growth as identified in the literature.

## 2. Frame work and empirical studies of economic growth

Some countries grow quickly; some countries grow slowly. Academics and policy-makers have long been puzzled by the coexistence of uneven, erratic growth trajectories of some less developed countries and the rapid, sustained growth paths of others. This discrepancy in economic growth among various countries has become a tantalizing research target for scholars.

A framework for determining growth is succinctly provided by Barro (1997). In this model,

$$g = f(y, y^*)$$

where $g$ is the growth rate of per capita output (e.g., Gross Domestic Product), $y$ is the current level of per capita output, and $y^*$ is the steady-state level of per capita output. At the steady-state level, the level of output per worker still increases because of exogenous labor-augmenting technological innovations, although the output per effective labor will remain constant.[1] In such an economy, output, consumption, and investment will be able to grow at the same rate. It should be understood that steady-state growth is a useful concept only in understanding economic growth. In reality, it is rather difficult to determine if

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[1] The effective labor can be expressed as $L_e = L_0 * e^{gt}$, where $L_e$ is the effective labor, and $L_0$, the initial labor; $g$ is the growth rate of technological progress and $t$, time.

Table 1
Real national income available per capita (RMB), base year 1997

|      | Guangdong | Fujian | Jiangsu  | Gansu  | Shanxi | Yunnan |
| ---- | --------- | ------ | -------- | ------ | ------ | ------ |
| 1977 | 247.28    | 193.82 | 250.98   | 240.54 | 245.62 | 208.63 |
| 1989 | 1,069.36  | 856.06 | 1,044.08 | 758.54 | 753.47 | 574.06 |

Source: Hsueh et al. (1993).

steady-state growth has been obtained.[2] The steady-state level of output is determined by economic, social, cultural, demographic, and political structures. It depends on, among other factors, savings and consumption patterns. For a society with a propensity toward consumption and an aversion to savings, that country's steady level of output is lower, keeping everything else constant, than a country that saves and invests a lot.

In addition to economic and demographic factors, the output at the steady-state level is determined also by political and social institutions—including tax rates, the extent of distortions in markets and business decisions, maintenance of the rule of law and property rights, and the degree of political freedom (Barro, 1997, p. 16).

Given the steady-state level output $y^*$, an increase in output decreases its growth rate because of diminishing returns (i.e., $(\partial g)/(\partial y) < 0$). Given the current output level $y$, an increase in the eventual equilibrium level of output $y^*$, as a consequence of improvements in exogenous conditions favorable to the economy, will increase the growth rate of output (i.e., $(\partial g)/(\partial y^*) > 0$).

Many economic variables are considered important for economic growth, including investment, human capital, international trade, and inflation. In Levine and Renelt's (1992) systematic study of numerous economic factors that may account for long-run aggregate economic growth, trade and investment are identified as major inputs for growth, although the effect of trade on growth weakens when controlled by investment. They also find that the initial level of development has a negative effect on growth, conditional upon the level of human capital. Human capital invariably is found to exert a positive impact on growth, although this effect does not hold over the period of 1974–1989.[3] Barro (1991, 1997) identifies that among a multitude of variables, initial levels of GDP, initial levels of human capital, fertility rates, government consumption, the rule of law index and trade all have some effects on growth.

## 3. Casual observations

Before we analyze the cross-province data in China, we conduct a preliminary statistical examination and comparison of a few provinces from both the coastal and inner regions,

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[2] One example is China whose economy has been growing at an annual rate in the neighborhood of 10 percent. Though its growth rate appears relatively stable, it is unlikely to be the steady-state growth, as its economy is not mature and institutionalized when compared with advanced industrialized countries.

[3] See Ross Levine and David Renelt (1992), "A sensitivity analysis of cross-country growth regressions," *American Economic Review* 82: 942–963.
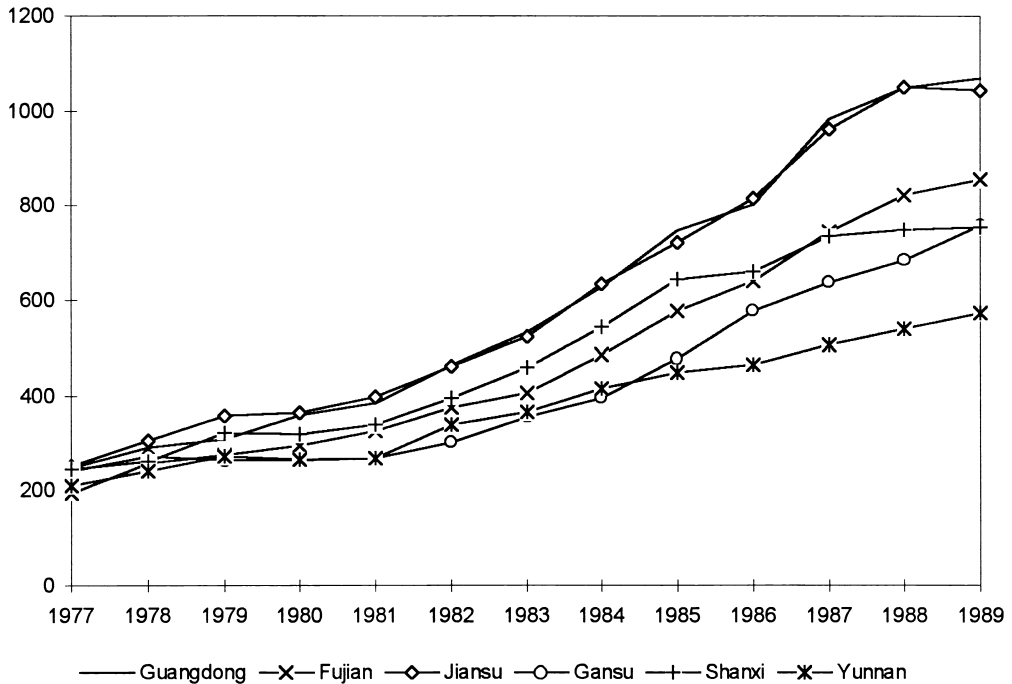
Fig. 1. Real national income available, base year 1977.

namely, the Fujian, Guangdong, and Jiangsu provinces along the coast and Gansu, Shanxi, and Yunnan inland. We use the annual data collected by Hsueh et al. (1993). Table 1 lists the real provincial income per person in 1977 and 1989, with 1977 as the base year.

The retail price index is used to convert nominal income into real income. In 1977, the year before economic reform stared in China, all the coastal and inner provinces had a similar level of income per capita. But after 12 years of economic reform, all three coastal provinces had higher income levels per person than the three inner provinces. The Fujian province was the poorest of the six in 1977 (with Jiangsu, the richest), but it became the third richest province of the six by 1989. Fig. 1 shows this change of real income for these provinces from 1977 to 1989.

Table 2 shows the regional growth rates of real income per capita for the pre-reform (1950–1977) and the post-reform (1977–1989) periods. The pre-reform growth rates were merely 3–5 percent, compared to a growth rate of roughly 10 percent in the post-reform period. It is easily discernable that economic reform accelerated growth not only in the coastal provinces but also in the inner region, which suggests that the reforms generated across-the-board economic growth in China. The presumption that only the coastal region reaped the fruits of economic reform while the inner region was deprived of a golden opportunity is mostly likely baseless.

However, the inner provinces grew faster before the economic reform started. Their average growth rate was 4.9 percent, higher than that of the coastal provinces. But the post-reform period evidences the opposite result: The coastal provinces have an average growth rate of

Table 2
Growth rate of real income per capita

|  | Guangdong | Fujian | Jiangsu | Gansu | Shanxi | Yunnan |
|---|---|---|---|---|---|---|
| 1950–1977 | 3.43 (0.104) | 3.18 (0.185) | –[a] | 4.82 (0.241) | 4.86 (0.199) | 4.97 (0.141) |
| 1977–1989 | 12.20 (0.061) | 12.20 (0.067) | 11.88 (0.063) | 9.57 (0.072) | 9.34 (0.075) | 8.43 (0.068) |

Note: The standard deviation of growth rate is in parentheses.

[a] Hsueh et al. (1993) do not provide the retail price index for Jiangsu before 1977, which prohibits the calculation of the real income per capita.

Table 3
Income gap of coastal and inner provinces

|  | Coastal provinces | Inner provinces | Income gap | % of Coastal income |
|---|---|---|---|---|
| 1977 | 230.69 | 231.59 | −0.9 | −0.39 |
| 1989 | 989.83 | 695.47 | 294.36 | 29.7 |

Source: Hsueh et al. (1993).

Real income available is measured as RMB yuan in 1977 price.

12.1 percent, and the inner provinces 9.1 percent. The economic reforms benefited the coastal provinces more than it did the inner provinces.

Lastly, we notice that the standard deviation of the growth rate is much higher in the pre-reform period than in the post-reform period, indicating that growth in the post-reform period was more stable than in the pre-reform period. The underlying reason is that China did not have a consistent policy for economic growth prior to the reform period, since it was caught in political turbulence. Such a pattern is consistent with the cross-country evidence indicating that the growth trajectory in many Latin American and African countries is characterized by two traps: Low average growth rates and large fluctuation (Feng, 2000).

Because of the difference in the growth rate between the coastal and inner provinces after 1978, the income gap between these two regions has been enlarged. The average pre-reform per capita real income for the inner provinces was higher than the coastal provinces, but by 1989, the average income in the coastal provinces was 294 yuan higher than the provinces in the inner region. The income gap changed from −0.9 percent to 29.7 percent in favor of the coastal area, suggesting that economic reform enlarged income inequity between these coastal and inner provinces (Table 3).

Table 4 compares several relevant factors that may affect growth, including the share of output value produced by non-state-owned firms as a percentage of the industry's gross output value, exports and imports as a ratio to gross domestic product, and educational attainment. Non-state-owned firms consist of collective-owned and privately owned firms. We can make several observations based upon Table 4. First, the higher-growth coastal provinces have a higher share of non-state enterprises. On average, the share of non-state-owned enterprises in the coastal provinces is 44.8 percent, more than twice the share in the inner provinces.

Interestingly, in Jiangsu, the share of non-state enterprises is more than 50 percent, but only about 3 percent of the gross industry output value is produced by private enterprises. We

Table 4
Comparison of some growth factors

| | Growth rate | Share of non-state firm (%) | Share of private firm (%) | Trade as a percentage of income | Students in high education | Students in secondary education | Students in primary education |
|---|---|---|---|---|---|---|---|
| Guangdong | 12.20 | 44.09 | 15.16 | 31.1 | 5.80 | 262.6 | 712.3 |
| Fujian | 12.20 | 38.36 | 9.00 | 15.0 | 3.83 | 114.9 | 362.7 |
| Jiangsu | 11.88 | 51.84 | 3.13 | 8.8 | 10.32 | 307.5 | 729.0 |
| Gansu | 9.57 | 11.13 | –[a] | 2.4 | 2.16 | 102.5 | 290.7 |
| Shanxi | 9.34 | 30.79 | 1.38 | 6.1 | 3.48 | 173.4 | 354.6 |
| Yunnan | 8.43 | 23.58 | 2.11 | 4.1 | 2.71 | 112.1 | 462.3 |

Source: Hsueh et al. (1993).
Students enrolled in higher, secondary and primary education are measured as 10 per thousand people. All data are the average of the period from 1977 to 1989.
[a] Hsueh et al. (1993) provide only one year data for Gansu's output value of private firms.

suspect that most non-state firms are the so-called town and village enterprises. The data suggest that a higher percentage of collective and private enterprises probably contribute to higher economic growth.

Second, the coastal provinces tend to be engaged in foreign trade, whereas the inner provinces tend not. The openness of these coastal provinces is likely an important factor conducive to higher growth.

Third, the coastal provinces on average have produced more human capital than the inner provinces. The average number of students in higher, secondary and primary education in these coastal provinces are 6.65, 228.3, and 601.3 (per 10,000), respectively, while the comparable numbers for the inner provinces are 2.78, 129.3, and 369.2 (per 10,000). These results, consistent with cross-country economic growth data, point to the importance of education in promoting economic growth.

## 4. Research design and data

Based on the findings in cross-country growth literature and our discussion on China, we adopt the following basic multivariate statistical model to investigate the impact on economic growth across provinces in China:

$$g_i = \alpha + \beta_1 \text{GDP}_i + \beta_2 \text{EDU}_i + \beta_3 \text{FERT}_i + \beta_4 \text{SOE}_1 + \beta_5 \text{INFLATE}_i + \beta_6 \text{TRADE}_i + \varepsilon_i$$

where the subscript $i$ refers to province $i$, $g$ denotes the growth rate in real provincial income per capita, GDP is the initial level of development, EDU is the initial level of human capital accumulation, FERT denotes crude birth rates at the beginning of the data, SOE stands for the presence of state-owned enterprises, INFLATE indicates the level of inflation, TRADE denotes trade, and $\varepsilon$, the error term. All data are obtained from Hsueh et al. (1993).

This work adopts a cross-country analytical approach, which requires averaging the values of the relevant variables for a fairly long period of time. The advantage of this

method is that it allows us to examine long-run trends of economic growth. In our study, the growth rate of real GDP per capita, our dependent variable, is averaged from 1978 to 1989.

This study incorporates the economic variables identified as important stimulants to growth, drawing heavily on major findings in the study of economic growth. The neoclassic model of growth argues that the growth rate tends to be negatively related to the absolute level of per capita GDP, owing to diminishing returns to capital (Solow, 1956); numerous empirical findings support this argument (e.g., Barro, 1991). The implication of these theoretical and empirical results is that given similar preferences and technologies, poor countries tend to grow faster than rich countries, thus converging toward the same level of income (the convergence hypothesis). The main reason for this phenomenon in neoclassical growth models is diminishing returns to reproducible capital. Poor countries tend to have low ratios of capital to labor, and consequently have high marginal products of capital. Therefore, they tend to grow at relatively high rates.

In this study, we use real GDP per capita in 1980 as an indicator of the initial level of economic development for the period of 1978–1989.[4] If the notion of convergence is correct, initial levels of income should be negatively related to subsequent growth rates.[5] Thus, we expect the initial real provincial income per capita (GDP) to have a negative effect on growth.

Human capital plays a critical role in endogenous growth models, which hold that knowledge-driven growth can lead to a constant, or even increasing, rate of return. In Romer (1990), for instance, human capital is the major input to research and development that innovates technologies. Therefore, countries with larger initial human capital stock are more likely to have new products and grow faster than other countries. Empirical evidence also has revealed a positive relationship between education and growth.[6] Barro (1991) uses the elementary school enrollment rate in 1960 (*PRIM60*) as a proxy for the

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[4] Though the provincial series starts in 1977, a few provinces do not have observations in that year. The use of 1980 as the initial year allows us to have the maximum cross-provincial observations, which is 29. Tibet is excluded for lack of price data and Taiwan is not considered here for obvious reasons.

[5] The convergence hypothesis maintains that (1) if countries are similar in terms of preferences and technology, the steady state income levels for them will be the same and with time they will tend to reach that same level of income and (2) that provided technology is a public good equally shared, all countries will eventually attain the same steady state growth, where the steady states of the economies refer to the economy where per capita output, capital stock, and consumption grow at a common constant rate equal to the exogenously given rate of technological progress. However, judging whether countries are in their steady states can be problematic. One way to bypass this problem is to examine the relationship between initial income levels and subsequent growth rates.

[6] For the theoretical argument, see Robert E. Lucas, "On the mechanics of economic development," *Journal of Monetary Economics* 2 (1988): 3–42; Paul Romer, "Increasing returns and long-run growth," *Journal of Political Economy* 94 (1986): 1002–1037; "Endogenous technological changes," *Journal of Political Economy* 98 (1990): S71–S102; and Alwyn Young, "A Tale of two cities: Factor accumulation and technical change in Hong Kong and Singapore," *NBER Macroeconomic Annual* (1992). For empirical works, see Ross Levine and David Renelt, "A sensitivity analysis of cross-country growth regressions"; Robert Barro, "Economic growth in a cross-section of countries" and Alwyn Young, "A tale of two cities: Factor accumulation and technical change in Hong Kong and Singapore."

initial stock of human capital for the period 1960–1985. This variable is calculated as the number of students enrolled in primary schools relative to the total population.[7] Instead of primary school enrollment, we use higher education enrollment as an indicator of human capital accumulation. The variation of primary enrollment across provinces in China is low, as primary education was mandatory during the period under study.[8] Like GDP, the initial year of 1980 is adopted for EDU. We expect that education has a positive effect on growth.

High fertility often indicates the opportunity cost of economic growth, and has been found to have a negative consequence on growth (e.g., Barro, 1997). Barro and Lee (1993) find that the effect of female school attainment on fertility is negative and highly significant, which is consistent with the idea that female educational attainment reduces fertility (Schultz, 1989; Behrman, 1990). When women aspire to more education and become more productive in the economy, their fertility declines. Furthermore, an increase in the number of children in a family directly augments non-educational spending, on such items as clothes and bedding, which diverts resources from learning. The average quality of education provided to children consequently decreases, thus reducing economic growth. In this study, we use birth rates as an index for fertility. To avoid the endogeneity problem, the birth rate in 1980 is used and the variable is expected to have a negative effect on growth.

The theoretical arguments regarding the effects of inflation on growth appear to be ambivalent. The Tobin–Mundell hypothesis states that anticipated inflation causes portfolio adjustments that lower the real rate of interest and raise investment and growth. Stockman (1981) finds that a higher level of anticipated inflation reduces economic activities, thus lowering investment and growth. De Gregorio (1993) suggests that the effect of the inflation level on investment is negligible if the elasticity of intertemporal substitution is sufficiently small. Recent empirical cross-country studies tend to find a negative effect of inflation on growth.[9] Since this study deals with various Chinese provinces caught in transitional economies that involve economic uncertainty, which depresses economic activity, we expect the sign on inflation (INFLATE) to be negative. The variable is the average rate of inflation for the 1978–1989 period.[10]

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[7] Strictly speaking, this variable is different from the one used by Barro (1991) who defines the enrollment rate as the number of students enrolled in the designated grades in primary schools relative to the total population of the corresponding age group. As thus constructed, the ratio may be larger than one. In this study, we do not have the information on the total population of the corresponding age group.

[8] The regression result using primary education produces an insignificant parameter estimate for primary school enrollment.

[9] For example, Kormendi and Meguire (1985) find that inflation negatively impacts growth, and Schneider and Frey (1985) establish a negative effect of inflation on foreign direct investment. See Roger C. Kormendi and Philip G. Meguire, "Macroeconomic determinants of growth: Cross-country evidence," and Friedrick Schneider and Bruno Frey, "Economic and political determinants of foreign direct investment," *World Development* 13 (1985): 161–175.

[10] The formula is $(p_t - p_{t-1})/p_{t-1}$, where $p$ is the GDP deflator.

Export promotion has been considered an important instrument for growth, especially for developing countries.[11] As East Asia's historical experience shows, a developing country can promote its economic growth by specializing and exporting. Through an export-oriented development strategy, a country can raise factor productivity, efficiently use its resources and increase its technological innovations. Also, as the economy expands, the country tends to be integrated into international markets, which may increase capacity utilization and improve gains of scale effects. In this study, we average the exports and imports as a percentage of provincial GDP for the 1978–1989 period. We expect that this variable has a positive impact on growth.

Finally, state-owned enterprises (SOE) represent a thorny issue in China's economic reforms. Take the Liaoning province, for example. According to a report by Song et al. (1996), the large or medium-sized SOE in Liaoning recently have faced some serious problems, including negative revenues, slow expansion, and profit decline (Song et al., 1996). In 1994, among the 4,109 SOE surveyed, 1,532 of them, or 37.8 percent, were in the red. By comparison, among collectively owned enterprises, only 18.9 percent were in the red, as were 23.9 percent among other kinds of enterprises. In 1995, SOE continued to lose money. The losses incurred that year by large or medium-sized enterprises increased 40.3 percent over 1994, constituting 58 percent of the total losses incurred in the province's industrial sector. Some SOE had to shut down. From 1978 to 1994, the total value of the output produced by the SOE increased by 110 percent, with an average annual increase rate of 4.9 percent. By comparison, the collectively owned enterprises increased by 820 percent, with an average annual growth rate of 14.9 percent. Other enterprises increased by 3,100 percent, with an annual rate of 30.6 percent. Finally, the profit of SOE is significantly lower than other enterprises. During 1989–1990 when the Chinese economy underwent contraction, the earning per ¥100 RMB of fixed capital assets gained only 0.5–0.8 percent for the SOE, down from 11.8 percent in 1985. In comparison, the drop for the collectively owned and other enterprises was relatively small.

The poor performance of SOE is ascribed to their lack of adaptability to market mechanisms pivoted on prices. "The SOE and the government departments in charge of them have been influenced by, and grown used to, the centrally planned economy; they lack flexibility in the marketplace. Furthermore, the SOE do not have the true autonomy over management due to a lack of distinction between government and business" (Song et al., 1996, p. 85). Besides, the SOE in Liaoning Province consisted largely of heavy industry, characterized by obsolete or obsolescent technology, raw material processing, and long production cycles. For years, technological innovations have been slack. Due to low-skilled labor, a single product line, and obsolescent technology and equipment, it is difficult for the SOE to develop and manufacture profit-earning new products. Their inventories have been on the rise, causing a slow turnover of capital. Also, the SOE owe debts to each other, making the shortage of capital increasingly severe. Thirty percent of

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[11] For instance, see Anthony M. Tang and James S. Worley, eds., "Why does overcrowded resource-poor East Asia succeed—Lessons for the LDCs?" *Economic Development and Cultural Change* 36 (1988), (supplement); Demetrios Moschos, "Export expansion, growth and the level of economic development," *Journal of Development Economics* 30 (1989): 93–102; and Ross Levine and David Renelt, "A sensitivity analysis of cross-country growth regressions."

Table 5
Regressions on cross-province growth rates in China

| | | | |
|---|---|---|---|
| INTERCEPT | 0.253 | 0.208 | 0.206 |
| | (10.12*) | (7.172*) | (7.357*) |
| GDP | −19.2 | −10.2 | −10.1 |
| | (−2.683*) | (−1.717**) | (−1.683***) |
| EDU | 5.566 | 3.803 | 3.65 |
| | (5.332*) | (3.055*) | (2.869*) |
| FERT | −0.002 | −0.001 | −0.001 |
| | (−4.0*) | (−2.222**) | (−2.000**) |
| INFLATION | −1.16 | −1.000 | −0.983 |
| | (−4.873*) | (−3.95*) | (−4.148*) |
| TRADE | 0.239 | 0.128 | 0.130 |
| | (4.051*) | (1.829**) | (1.831**) |
| SOE | −0.09 | −0.116 | −0.116 |
| | (−5.625*) | (−9.667*) | (−9.667*) |
| INDUSTRY | – | 0.036 | 0.036 |
| | | (3.000*) | (3.273*) |
| INVEST | – | – | 0.007 |
| | | | (0.25) |
| $R^2$ | 0.707 | 0.767 | 0.756 |
| $\sigma$ | 0.011 | 0.010 | 0.010 |

Notes: Numbers in parentheses are $t$-statistics based on the White consistent covariance of estimates.
* Significant at the 0.01 error level, one-tail.
** Significant at the 0.05 level, one-tail.
*** Significant at the 0.10 level, one-tail.

SOE employees are redundant; a massive layoff will cause very serious social and political problems. Finally, on top of all their other financial problems, SOE retirees constituted about 20 percent of total current employees in 1994, dragging down their profits since the enterprises are responsible for pensions (Song et al., 1996). Consequently, we expect the effect of the presence of the SOE on growth to be negative. The data on the SOE are derived from the output value of the SOE as a percentage of provincial income, and are averaged for the 1978–1989 period.

## 5. Empirical results

This section reports statistical results estimating cross-province growth rates in China. Four regressions are run on 29 cases. Of the 31 provinces, autonomous regions inhabited by minorities, and municipalities directly under the supervision of the central government in China, two are excluded. The price data on the Tibetan Autonomous Region are missing, rendering it impossible to calculate Tibetan real income. Also, for political as well as economic reasons, Taiwan Province is an outlier and an anomaly for this group of observations and is thus excluded.

Table 5 presents regression results using ordinary least squares (OLS) estimation. The asterisks *, **, *** indicate the error level at 0.01, 0.05 and 0.10, respectively, all in a one-tail

test. Because heteroskedasticity could be important across provinces, the standard errors for the coefficients are corrected on the basis of White's (1980) heteroskedasticity-consistent covariance matrix.

In Column 1, all the variables take the signs as expected and are statistically significant. The goodness of fit is quite satisfactory, with an adjusted $R^2$ as high as 0.707 and a standard error of regression as low as 0.011. While education and international trade have a positive effect on growth, initial level of development, birth rates, inflation, and SOE are found to have negative consequences on growth. All these findings are consistent with our theoretical expectations.

In Column 2, we add the degree of industrialization as a control variable. We use the gross output value of industry as a percentage of provincial income (INDUSTRY) as an index for industrialization, and expect that it has a positive impact on growth. A highly industrialized country or region often has the knowledge and technology that accelerate economic growth, based on the advances of technological revolutions and renovations. The fundamental conclusion of endogenous growth models (e.g., Romer, 1986) is that long-run economic growth can continue indefinitely due to technological innovations within the economic system. Knowledge spillover allows each unit of capital investment to increase the level of technology for all firms, as well as the stock of physical capital. The trend of industrialization in China is consistent with progress of technological innovation and upgrading. Therefore, different levels of industrialization in China across provinces may cause growth rates to vary. However, economic growth can also lead to industrialization, implying an endogeneity problem. To alleviate reverse causality, we use the initial level of industrialization in the year 1980 to estimate economic growth for the period of 1978–1989. Column 2 shows that industrialization in 1980 has a positive and significant effect on growth in this period. Noticeably, the magnitude and significance of initial levels of real GDP per capita, education, fertility, and trade decrease somewhat in the presence of industrialization, although they still maintain the expected signs and are statistically significant at the levels set a priori. This result should not be surprising. Industrialization is related to all of these channels, but may capture sources of growth that are not reflected by these variables. For instance, industrialization enhances social efficiency, which may have positive impact on long-run economic growth.

Column 3 includes investment share as a control variable in the regression. Investment has been considered the engine of growth. According to Kormendi and Meguire (1985) and Levine and Renelt (1992), investment share of GDP has a significant and positive effect on growth. However, according to Barro (1997), when underlying variables (e.g., fertility and education) that draw investment are accounted for, the direct effect of investment on growth loses its explanatory power.[12] We include the average ratio of fixed assets and circulating assets to provincial income (INVEST) for the period of 1978–1989 as a control variable. The parameter estimate on this variable has the expected sign, but is statistically insignificant. The results previously obtained in Column 1 and Column 2 still hold. The statistical evidence in Column 2 remains quite stable even when investment is included in Column 3.

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[12] We gratefully owe this observation to an anonymous reviewer's comment.

In summary, university enrollment as a percentage of population has a positive and significant effect on economic growth. This result may reflect the human capital source of endogenous growth in China. Likewise, international trade is conducive to economic growth, consistent with the open-door policy and the establishment of special economic zones to promote export-led growth at the early stage of China's reform. The birth rate, an indicator for fertility, has a negative consequence on growth, which may have some deep implications in the context of China's population policy. Similarly, the initial level of income is found to have a negative effect on provincial growth rates, confirming the exogenous growth model at a sub-national level. To our knowledge, ours is the first finding that the convergence hypothesis holds in the cross-province data in China. The presence of SOE and its composition in the economy are found to inhibit growth. This result indicates that China must overcome the negative imperatives of inefficient SOE in order to bring its economic reform to fruition.

## 6. Concluding remarks

The economic reform that started in 1978 has brought across-the-board benefits to all provinces in China. However, the coastal provinces have experienced much higher economic growth than the inner provinces. The uneven economic growth has resulted in a wider income gap between the coastal and inner provinces.

Some policy implications can be tentatively suggested here. First, in order to increase growth in the inner region, local and central governments should promote collective and private enterprises. We find that one characteristic of China's economic system—the share of SOE—negatively affects the country's economic growth. High growth in the coastal provinces since the economic reform in 1978 may very likely have been caused by the booming non-state-owned enterprises, which include collectively owned and privately held firms.

Second, inner provinces should engage more in foreign trade. To the extent that the cost of direct trade with foreign countries is high, these inner provinces may capture the external benefits of foreign trade by trading with coastal provinces, which trade with other countries at relatively low costs. Like foreign trade, inter-provincial trade is conducive to factor equalization and shared economic growth.

Third, local and central governments should emphasize education in the inner provinces. Not only should a larger share of government expenditures be spent on local school facilities and teachers' compensation, but also a labor system should be established to reward education. The system that retains the best and brightest brains and provides incentives for young people to be educated is one based on market mechanisms that link social status and financial incentives to educational attainment.

Fourth, to the extent that the widening income gap between the inner and coastal areas is a concern to the central government because of political instability and polarization, the central government should place more emphasis on the importance of growth and development of the Chinese hinterland. Policies of the central government should not be biased toward the coastal area.

Last but not least, to achieve maximum growth effects, the government fund, if available, should be used to open schools, improve health care systems, and build infrastructures that

facilitate efficient flows of goods and services across provinces. Based on what we have learned from the township–village-enterprises (TVE) and privately owned enterprises in the coastal provinces, funding efficient non-state-owned enterprises in the inner provinces can significantly increase economic growth in the poor inner areas.

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