What Happened to China's Relative Steady State?

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I am really indebted to Professor Serge Coulombe and Professor Kathleen Day.

I could not finish such a major paper without their many important advices.

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Abstract

In this paper, a country's relative steady state means a particular country's steady state relative to the average steady state of a broad set of countries. It will be shown that China's relative steady state improved between the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period). One explanation for this is an improvement in China's social infrastructure during its reform period. It will also be shown that China's relative steady state is still far below the typical level of those of developed countries.

Introduction

Economic growth convergence theory predicts that any economy converges to its steady state which is predetermined by its saving rate, labour supply growth rate, capital depreciation rate and rate of technological progress. This theory implies that an economy's steady state can change between two periods if the above determinants change between the two periods, and that one economy's steady state can be different from that of another in one period if they do not share the above determinants in this period.

Because an economy converges to its steady state automatically and naturally, a country (an economy) can become as rich as the developed countries if its steady state is located at the level of those of developed countries, regardless of how poor it is initially. For example, although both Germany and Japan were poor countries at the end of World War II because their physical capitals were heavily damaged in the war, their steady states at that time remained at the level of those of developed countries (the evidence for that is given in Table 10 in section VI of this paper). This can explain why both became rich and developed countries again about 30 years after World War II. Therefore, a study of whether a country's steady state changes or whether a country's steady state reaches the level of those of developed countries is definitely worthwhile.

In practice, an economy's steady state can be empirically measured in relation to the levels of those of other countries. For example, an economy's steady state can be empirically represented by its relative steady state. In this paper, a country's relative steady state means a particular country's steady state relative to the average steady state. Thus a study of whether a country's relative steady state changes should be equally valuable. If one wants to verify that a change has occurred, this causes the question: how does one test whether a country's relative steady state changes between two periods? Fortunately, there exists a way to solve this problem.

Through testing the hypothesis of conditional convergence across a broad set of countries which are believed to have different steady states, one can obtain an estimate of a country's relative steady state in a given period. By testing such an hypothesis for different periods, one can obtain the estimates for different periods. Next, one can use a Wald test to assess whether the change in this country's relative steady state is significant between two periods. In addition, through comparing the estimate of a country's relative steady state with the estimates of those of developed countries, one can also determine whether its relative steady state has reached the level of those of developed countries and how big the gap is.

This paper pays special attention to China's relative steady state in two continuous periods, the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period). A Wald test shows that China's relative steady state improved significantly between the two periods. One explanation for this is that China's social infrastructure has been improved during its economic reform starting in 1979. The estimates also suggest that China's relative steady state has not reached the level of those of developed countries even after the improvement.

The paper consists of seven sections. Section I is a brief review of previous studies on the convergence of China's economy and section II provides the explanations of several concepts relating to economic growth convergence that are used in this paper. In the next section, the regression equation used to test the hypothesis of conditional convergence will be described. In section IV, the data used to estimate the regression equation and the empirical methodology used to assess whether China's relative steady state changed between the above two periods will be described and the details of both results and analyses will also be shown. After section V, which suggests two main reasons why China's relative steady state could improve, a comparison of China's relative steady state to those of some other countries will be presented in section VI. Conclusions will be made in section VII.

I. A brief review of previous studies on convergence of China's economy

China's economy has developed rapidly since China started its economic reform at the end of the 1970s. This has drawn extensive attention from economists all over the world. Especially in the 1990s and at the dawn of 21st century, many economists showed unprecedented interest in China's economy and carried out numerous studies of China's economy. Among these studies are the studies on the convergence of China's economy, which can be classified into two varieties:

1. The studies on convergence of China's economy that were made through examining GDP per capita convergence across Chinese provinces or regions.

2. The studies on the same topic that were done through examining GDP per capita convergence across countries including China.

The studies in Variety 1 generally indicated an increasing disparity in GDP per capita across Chinese provinces or regions over last twenty years. For example, Jian, Sachs, and Warner (1996) point out that China's regional incomes have begun to diverge obviously during its reform period. They also note that such a divergence is mainly caused by an increase in the gap between the income per capita of coastal provinces and that of interior provinces. So China developed, in its reform period, with a prosperous and fast growing coastal region and a poor and relatively slowly growing interior one. Aziz and Duenwald (2001) indicate as well that China's rapid overall growth since 1979 showed significant differences in relative economic performance across Chinese provinces, and the provinces in eastern China achieved, in general, obviously higher growth rates of GDP per capita than those in western China. As for the reasons for an increase in regional disparity in China in its reform period, Zhang (2001) argues that the international trade and foreign direct investment are the main reasons. He also points out that the international trade and foreign direct investment were concentrated in the coastal region because the coastal region had an inherent comparative advantage (such as relatively low labour costs, better infrastructure facilities, closer relations with overseas Chinese, lower transportation costs, etc.) and also enjoyed the Chinese government's preferential policies in the reform period. Jones, Li, and Owen (2003) even predict that the disparity in levels of average incomes of Chinese provinces or regions will increase as the Chinese economy continues to grow. All the above economists argue that there was an increase in disparity in GDP per capita across Chinese provinces or regions during its reform period.

The studies in Variety 2 generally announced, in GDP per capita terms, an increase in population-unweighted world inequality across countries but a decline in population-weighted world inequality during the last two decades of the 20th century, which is, to a large extent, driven by China's fast growth during this period. For example, Schultz (1998) shows that the variance in the logarithms of GDP per capita in the world sample (in purchasing-power-parity prices) has decreased since the middle of 1970s, and if China is excluded from the world sample, the decline in population-weighted world inequality after 1975 is not evident. Robert (2000) argues as well that China's fast growth has significantly changed the world's income distribution because it undoubtedly benefited the poor, and if China is removed from the world sample, the level of world income inequality remained almost the same over the last twenty five years. Dollar (2004) shows that population-weighted world inequality increased up to 1975 but decreased quite markedly later. The reason for this is that China, India and some other developing countries developed faster on average than the developed countries during the last twenty years. As for the reason for a decline in population-weighted world inequality, Ghose (2004) indicates as well that some developing countries (such as China and India) achieved significantly faster economic growth than the developed countries during the last twenty years, and although the number of them is small, they actually account for a majority of the population of the developing world. Thus population-weighted world inequality actually declined even if the per capita income inequality across countries increased. Firebaugh and Goesling (2004) argue that population-weighted world inequality declined in the last two decades of the 20th century. They make the same explanation for that: China and South Asia, developing regions whose population account for 40% of the world's, experienced faster growth of per capita income than the rest of the world during this period. Crafts (2004) concludes that the recent reversal of the world inequality trend is owed primarily to China's remarkable economic growth during the last two decades. These economists agreed a decline in population-weighted world inequality (in GDP per capita term) during the last 20 years, which is, to a large extent, driven by the rapid growth of China's economy during this period. According to their analyses, it is reasonable to think that there could be, in GDP per capita terms, an increase in China's position in the world, which is caused by its economic reform starting in 1979.

But from the studies in both varieties, there is no study focusing on whether there was a change in China's steady state or relative steady state between its pre-reform period and reform period. China's economy has developed much faster for over twenty years than it did before 1979, so it is the right time to make a study of what happened to China's steady state or relative steady state. As mentioned in the introduction section, the level of the steady states or relative steady states of developed countries is different from the level of those of less developed countries. Thus a study of whether a less developed country's steady state or relative steady state changes is of interest. This paper will study whether China's relative steady state changed between the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period).

II. The explanations of several concepts relating to economic growth convergence

Economic growth convergence theory stems from the Solow model.[1] The analysis in this paper involves several concepts relating to economic growth convergence: the steady state, social infrastructure, the speed of convergence β and β-convergence. Among the above four concepts, the first two are associated, as are the second two. Explanations of them are given in the remainder of this section.

The steady state is an important concept in economic growth convergence theory. In Figure (2.1),[2] k denotes capital per unit of effective labour, $f(k)$ denotes output per unit of effective labour, n denotes the population growth rate which is regarded as the labour supply growth rate, g denotes the technological progress rate which is constant in the Solow model, δ denotes the capital depreciation rate, s denotes the saving rate, $sf(k)$ denotes saving at given $f(k)$, the $sf(k)$ curve is the saving curve, $(n + g + \delta)k$ denotes break-even investment at given k, and the $(n + g + \delta)k$ curve is the break-even investment curve. The economy's steady state is located at the intersection of the economy's saving curve and break-even investment curve. When saving equals break-even investment, i.e. $sf(k) = (n + g + \delta)$, the capital stock per unit of effective labour k is constant. Thus an economy is at its steady state, that is to say, $k = k^*$ (k^* is the steady state value of k.) and $f(k) = f(k^*)$ ($f(k^*)$ is the steady state value of $f(k)$.).

Figure (2.1) also shows that if the initial k is less (larger) than k^*, saving $sf(k)$ is larger (less) than the break-even investment $(n + g + \delta)k$ and the change in k is positive (negative), so k increases (decreases) until k equals k^*. That is to say, k will change until k equals k^* as long as the initial value of k does not equal k^* or an economy always converges to its steady state.

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[1] See Romer (2001).

[2] This figure is borrowed from Coulombe (2004).

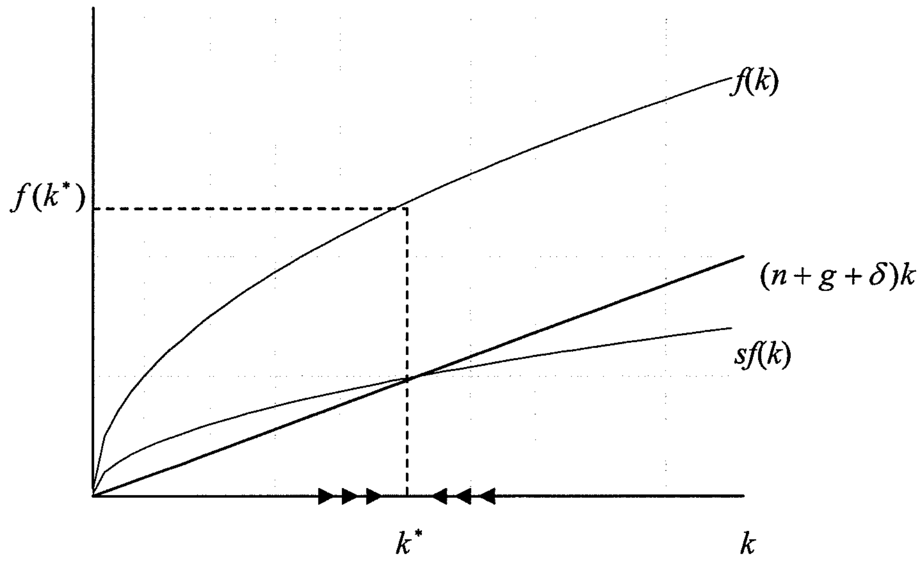

Figure (2.1)

Social infrastructure is another important concept relating to economic growth convergence. Actually, social infrastructure is closely associated with the steady state because an economy's social infrastructure determines, to a large extent, its steady state. But it is very difficult to define social infrastructure as precisely as the steady state is defined. Romer (2001, p.143) describes social infrastructure as "institutions and policies that encourage investment and production over consumption and diversion." Romer points out further that social infrastructure can determine both people's activities in investment and consumption and people's activities in production and diversion. Generally, one can simply regard social infrastructure as those institutions, policies, traditions and cultures which are associated with economic growth. Thus a change in social infrastructure (i.e. changes in institutions, policies, traditions and cultures associated with economic growth) has an effect on economic growth, especially on steady state.

Social infrastructures in developed countries are much superior to those in less developed countries because they promote investment and production over consumption and diversion much more effectively than those in less developed countries. To a large extent, this explains why developed countries' steady states are much higher than those of less developed countries. In reality, most countries (economies) are close to their steady states. This suggests that developed countries are much richer (in per capita terms) than less developed countries because their steady states are much higher than those of less developed countries. Because a good social infrastructure can create a high steady state, then whether a country can become a developed country depends, to a large extent, on whether it has a good social infrastructure. If a country has a good social infrastructure to begin with or if it has a poor social infrastructure initially but can transform the poor one into a good one later, it can become a developed country. Otherwise, it cannot.

In general, developed countries have similarly good social infrastructures, but less developed countries have poor social infrastructures, which can be demonstrated in different ways. Romer (2001, p.144) describes poor social infrastructures by saying

> Because social infrastructure has many dimensions, poor social infrastructure takes many forms. There can be Stalinist central planning where property rights and economic incentives are minimal. There can be kleptocracy-an economy run by an oligarchy or a dictatorship whose main interest is personal enrichment and preservation of power, and relies on expropriation and corruption. There can be near anarchy, where property and lives are extremely insecure. And so on.

Since the rate of technological progress g and the capital depreciation rate δ are considered exogenous in the the Solow model, one can only show how social infrastructure affects the steady state through its effects on the saving rate s and the population growth rate n. Figure (2.2)[3] shows that a higher saving rate s leads to a higher steady state value of capital per unit of effective labour k^*. A developed country has a good social infrastructure, which ensures that its saving rate is higher than that of a less developed country, i.e., $s_{rich} \rangle s_{poor}$. It results in $s_{rich}f(k) \rangle s_{poor}f(k)$ at any given k if assuming both have the same production function. Thus the saving curve of a developed country is higher than that of a less developed country. This explains why a developed country has a higher steady state due to its higher saving rate, i.e., $s_{rich} \rangle s_{poor}$ leads to $k^*_{rich} \rangle k^*_{poor}$, which means $f(k^*_{rich}) \rangle f(k^*_{poor})$ and $Af(k^*_{rich}) \rangle Af(k^*_{poor})$ at given A.[4]

[3] Figure (2.2) is borrowed from Coulombe (2004).

[4] A is technological progress and $Af(k^*)$ is the steady state value of output per unit of labour (real GDP per capita.).

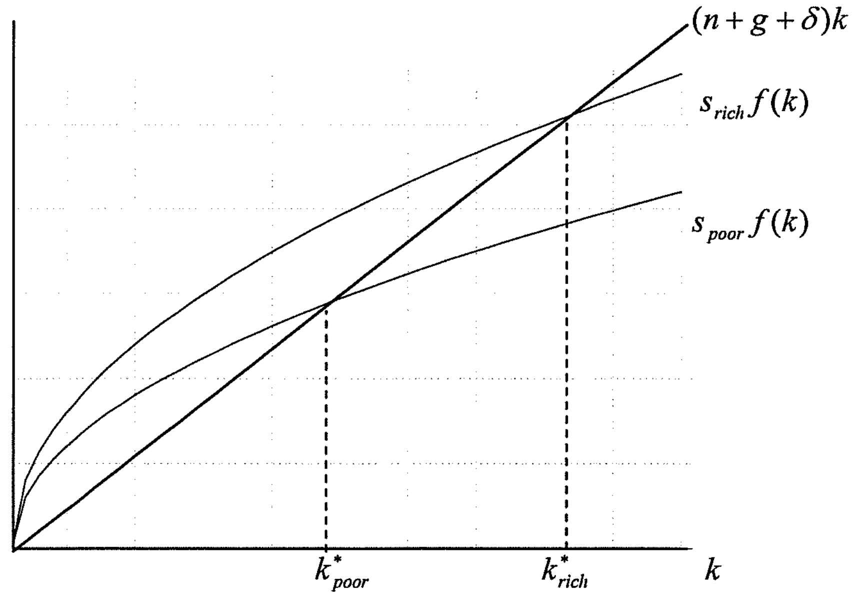

Figure (2.2)

Figure (2.3)[5] shows that a lower population growth rate n leads to a higher steady state value of capital per unit of effective labour k^*. A good social infrastructure in a developed country also allows its population growth rate to be lower than a less developed country's, i.e., $n_{rich} < n_{poor}$. This means $(n_{rich} + g + \delta)k < (n_{poor} + g + \delta)k$ at any given k, and the break-even investment curve of a developed country is lower than that of a less developed country. Figure (2.3) shows that a developed country has a higher steady state due to its lower population growth rate. That is to say, $n_{rich} < n_{poor}$ leads to $k^*_{rich} > k^*_{poor}$, which means $f(k^*_{rich}) > f(k^*_{poor})$ and $Af(k^*_{rich}) > Af(k^*_{poor})$ at given A.

The next concept is the speed of convergence β and the following equation[6] is used to explain it:

$$k(t) - k^* = e^{-\beta t}\left(k(0) - k^*\right) \qquad (2.1)$$

Equation (2.1) shows that a positive value of β means convergence while a negative value of β means divergence. β in equation (2.1) is assumed to be constant.

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[5] This figure is borrowed from Coulombe (2004).

[6] See Romer (2001, p.24).

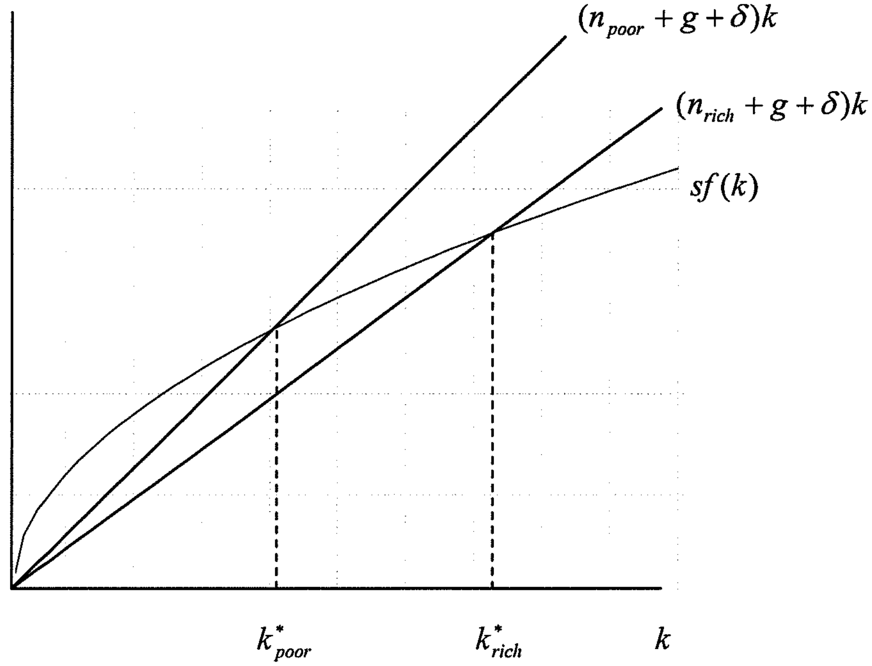

Figure (2.3)

However, this is true only in the long run (i.e., when k is near k^*). That is to say, one can imagine a constant speed of convergence when an economy's k is near its k^*. In reality, most economies are close to their steady states, so they are in a long-run situation.

But β varies in the short run (i.e., when k is not near k^*). "The speed of convergence, β, is measured by how much the growth rate γ_k declines as the capital stock increases in a proportional sense."[7] This quotation describes the behavior of the speed of convergence β in the short run when $k \langle k^*$. If one considers both $k \langle k^*$ and $k \rangle k^*$, the quotation should be corrected to read: the speed of convergence, β, is measured by how much the growth rate γ_k changes as the capital stock k moves toward k^* in a proportional sense. Thus β is large (small) if the change in γ_k is large (small); β decreases (increases) if the change in γ_k decreases (increases) as k moves toward k^* in a proportional sense. Figure (2.4)[8] shows β changes in the short run.

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[7] See Barro and Sala-I-Martin (2004, p.56).

[8] See Barro and Sala-I-Martin (2004, p.56).

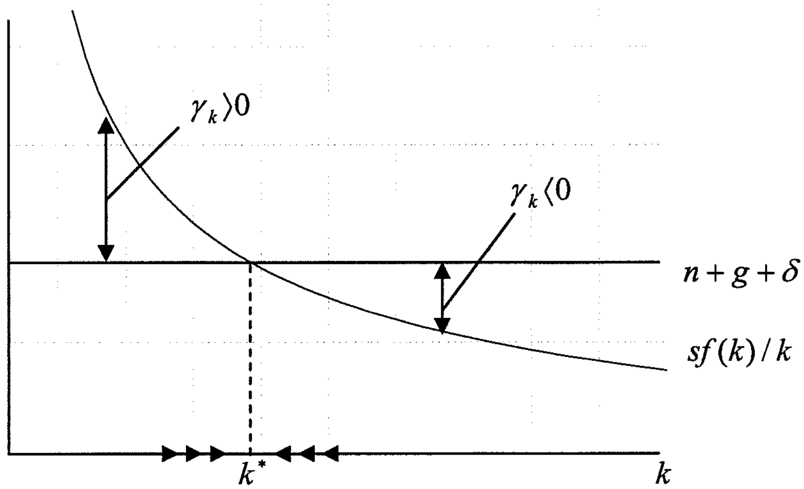

Figure (2.4)

β -convergence is named after the speed of convergence β . It can take two forms: absolute convergence and conditional convergence. Both use the same convergence indicator, which is a positive value of β . The following definitions of absolute convergence and conditional convergence imply that there must be one of them across a set of countries.

Barro and Sala-I-Martin (2004, p.45) define absolute convergence as follows: "the hypothesis that poor economies tend to grow faster in per capita terms than rich ones-- without conditioning on any other characteristics of economies-- is referred to as absolute convergence." This definition implies that the selected countries (economies) have the same steady state if they share all economic parameters. Since social infrastructure affects the steady state through its effects on economic parameters, it is reasonable to think that the selected countries can share all economic parameters if they have similar social infrastructures. Figure (2.5)[9] shows absolute convergence across two countries.

If two countries have similar social infrastructures, one can imagine that they have the same saving rate s, population growth rate n, rate of technological progress g and capital depreciation rate δ. Figure (2.5) shows that the two countries have the same steady state k^*, which implies both have the same $f(k^*)$ and $Af(k^*)$ at given A.

[9] This figure is borrowed from Coulombe (2004).

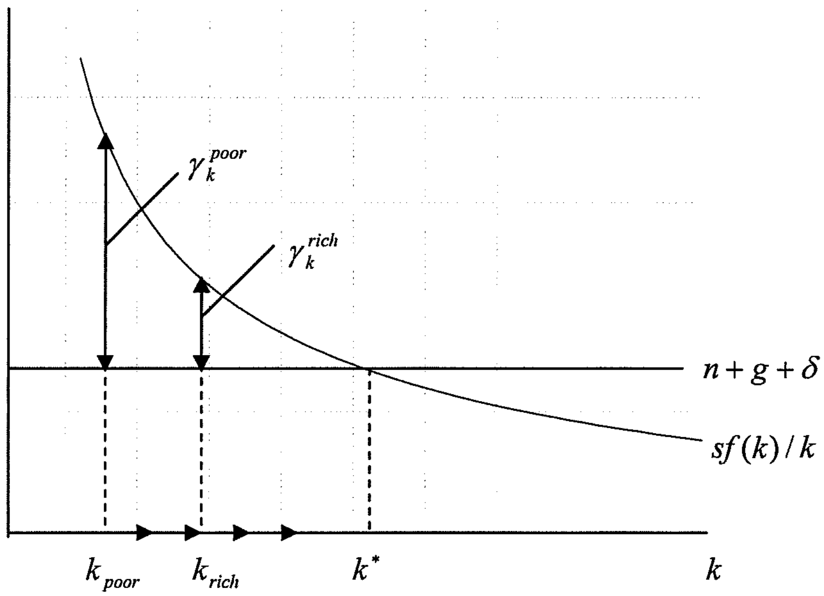

Figure (2.5)

Barro and Sala- I- Martin (2004, pp.46-47) describe conditional convergence as follows:

> If we allow for heterogeneity across economies, in particular, if we drop the assumption that all economies have the same parameters, and therefore, the same steady-state positions, if the steady states differ, we have to modify the analysis to consider a concept of conditional convergence. The main idea is that an economy grows faster the further it is from its own steady state value.

This definition asserts that the selected countries (economies) can have different steady states if they have different economic parameters. Figure (2.6) [10] shows the conditional convergence across two countries which have different saving rates but share other parameters. A developed country has a good social infrastructure, which allows its saving rate to be higher than a less developed country's. $s_{rich} \rangle\ s_{poor}$ means $s_{rich}\ f(k)/k$ $\rangle\ s_{poor}\ f(k)/k$ at any given k, thus the $s_{rich}\ f(k)/k$ curve is higher than the $s_{poor}\ f(k)/k$ curve. This leads to $k^*_{rich} \rangle\ k^*_{poor}$, which means $f(k^*_{rich})\rangle\ f(k^*_{poor})$ and $Af(k^*_{rich})\rangle\ Af(k^*_{poor})$ at any given A. Figure (2.6) shows that the two countries have different steady states due to their different saving rates.

[10] See Barro and Sala-I-Martin (2004, p.48).

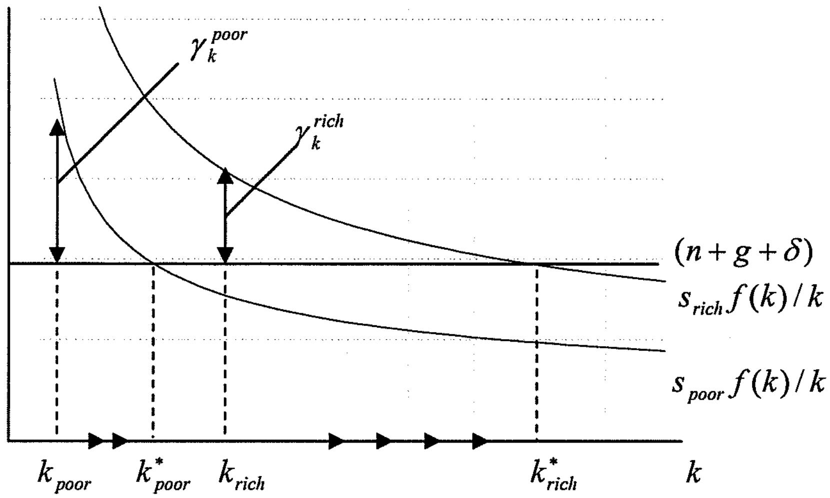

Figure (2.6)

Figure (2.7)[11] shows conditional convergence across two countries which have different population growth rates but share other parameters. A developed country has a good social infrastructure, which also allows its population growth rate to be lower than a less developed country's. $n_{rich} \langle n_{poor}$ makes the $n_{rich} + g + \delta$ curve lower than the n_{poor} +

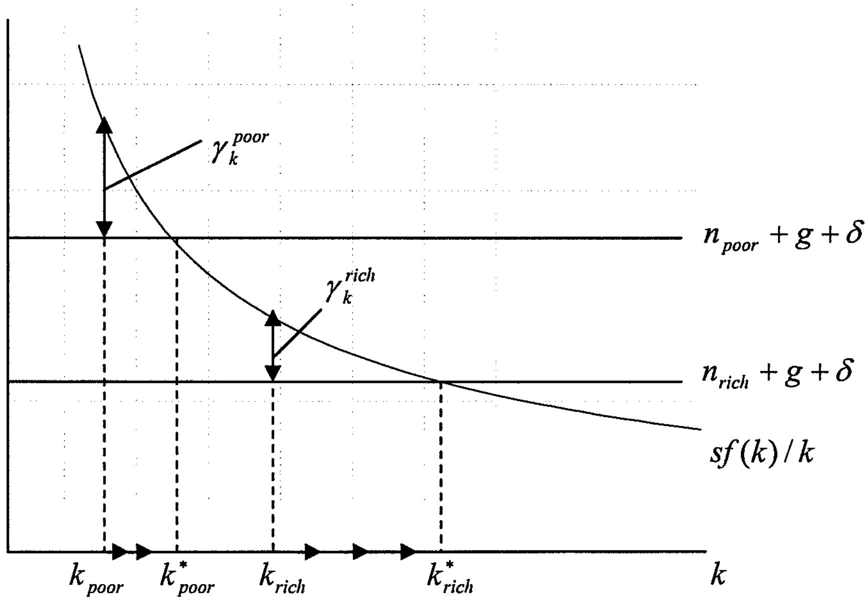

Figure (2.7)

[11] This figure is borrowed from Coulombe (2004).

$g + \delta$ curve. This results in $k^*_{rich} \rangle k^*_{poor}$, which means $f(k^*_{rich}) \rangle f(k^*_{poor})$ and $Af(k^*_{rich})$ $\rangle Af(k^*_{poor})$ at any given A. Figure (2.7) shows that the two countries have different steady states due to their different population growth rates.

III. A description of the regression equation used to test the hypothesis of conditional convergence

In this paper, the following equation is used to test the hypothesis of economic growth convergence across countries.

$$(1/T)\log\left(Y_{i,t}/Y_{i,t-T}\right) = \alpha_i - (1/T)\left(1-e^{-\beta T}\right)\log Y_{i,t-T} + u_{i,t}, \qquad (3.1)$$

where the subscript t denotes year t; the subscript i denotes country i; T denotes the length of the time interval; $Y_{i,t}$ denotes real GDP per capita of country i in year t; β denotes the average speed of convergence for all countries in the sample in a given period; $\alpha_i = x + (1/T)\left(1-e^{-\beta T}\right)\log Y_i^*$; x denotes the growth rate of technological progress, which is assumed to be the same and constant for all countries in the sample; and Y_i^* denotes the steady state value of real GDP per capita of country i. This equation is derived by Barro and Sala-I-Martin (2004. p.466).

Equation (3.1) implies that the average growth rate (between year t-T and year t) of real GDP per capita of country i depends positively on Y_i^* and negatively on $Y_{i,t-T}$ for all i. Since β is very small, the coefficient $(1/T)\left(1-e^{-\beta T}\right)$ almost equals β. Because the expression $(1/T)\left(1-e^{-\beta T}\right)$ declines with T, the estimate of β declines as the time interval T increases, that is to say, the larger the chosen T, the smaller the estimate of β obtained.

Equation (3.1) contains the time trend that is associated with the growth of technological progress. In order to remove the time trend, it is necessary to make a transformation of equation (3.1). For such a transformation, Coulombe (2004) defines $y_{i,t} = \log(Y_{i,t}/\bar{Y}_t)$ and $\bar{Y}_t$ is the cross section mean of $Y_{i,t}$ in year t and for all t. Thus $y_{i,t}$ is the relative real GDP per capita of country i in year t and for all t. So the word "relative" in this paper means "relative to cross section mean". The details of the transformation are shown as follows:

First, one can rewrite equation (3.1) as

$$(1/T)\left(\log Y_{i,t} - \log Y_{i,t-T}\right) = \alpha_i - (1/T)\left(1-e^{-\beta T}\right)\log Y_{i,t-T} + u_{i,t}, \qquad (3.1)^*$$

then one takes the mean over the number of countries N of this equation and obtains

$$(1/T)\left(\frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t} - \frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t-T}\right) = \frac{1}{N}\sum_{i=1}^{N}\alpha_i - (1/T)\left(1-e^{-\beta T}\right)\frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t-T} + \frac{1}{N}\sum_{i=1}^{N}u_{i,t}$$

$$\text{or} \quad (1/T)\left(\log \bar{Y}_t - \log \bar{Y}_{t-T}\right) = \bar{\alpha} - (1/T)\left(1-e^{-\beta T}\right)\log \bar{Y}_{t-T} + \bar{u}_{i,t}, \qquad (3.2)$$

where $\bar{Y}_t = \sqrt[N]{Y_{1,t}Y_{2,t}\cdots Y_{N,t}}$; $\bar{Y}_{t-T} = \sqrt[N]{Y_{1,t-T}Y_{2,t-T}\cdots Y_{N,t-T}}$; $\bar{\alpha} = x + (1/T)\left(1-e^{-\beta T}\right)\log \bar{Y}^*$;

and $\bar{Y}^* = \sqrt[N]{Y_1^* Y_2^* \cdots Y_N^*}$. Thus they are all cross section means.

Under the hypothesis of conditional convergence, each country has its steady state value which can be different from those of other countries, that is to say, Y_i^* changes with i. This means that Y_i^* does not equal $\bar{Y}^*$ for most i, thus α_i does not equal $\bar{\alpha}$ for most i. Through equation (3.1)* minus equation (3.2), the following equation is obtained.

$$(1/T)\Delta y_{i,t} = c_i - (1/T)\left(1-e^{-\beta T}\right)y_{i,t-T} + \varepsilon_{i,t} \qquad (3.3)$$

where $\Delta y_{i,t} = y_{i,t} - y_{i,t-T} = \log(Y_{i,t}/\bar{Y}_t) - \log(Y_{i,t-T}/\bar{Y}_{t-T})$; $c_i = \alpha_i - \bar{\alpha} = (1/T)\left(1-e^{-\beta T}\right)y_i^*$,

$y_i^* = \log(Y_i^*/\bar{Y}^*)$, so y_i^* is the relative steady state value of real GDP per capita of country i ; and $\varepsilon_{i,t} = u_{i,t} - \bar{u}_{i,t}$.

Equation (3.3) is estimated with fixed effects. Its constant term c_i, i.e., c(country i), is the fixed effect of country i for all i and can show the unobserved heterogeneity across countries (y_i^* is unobserved because Y_i^* is unobserved for all i.). Equation (3.3) is used to test the hypothesis of conditional convergence.[12] One would expect the regression results from estimating equation (3.3) to show that the estimates of the relative steady states of developed countries are statistically positive while the estimates of those of less developed countries are either statistically negative or not statistically significant.

[12] Under the hypothesis of absolute convergence, all countries have the same steady state value, thus equation (3.1) minus equation (3.2) yields an equation which does not have the constant term c_i .

IV. The data, the empirical methodology, the results and the analyses

IV.1. The data.

The Penn World Table version 6.1 (http://datacentre2.chass.utoronto.ca/pwt/) provide data on real gross domestic income (real GDP per capita--adjusted for terms of trade changes) of most countries in the world. The downloaded data used in this paper cover the years from 1950 to 2000 and include 114 countries which are listed in Appendix A. Thus the data are pool time series cross section data.

Among the 114 countries are some in Asia, Africa, Western Europe, Eastern Europe, North America, South America, and the rest of the world. Because the 114 countries (including China) certainly do not have the same social infrastructure, as analyzed before, they may have different steady states. Therefore, the data are appropriate to test the hypothesis of conditional convergence.

IV.2. The empirical methodology, the results and the analyses.

The empirical methodology used to assess whether China's relative steady state changed between the 1950-1979 and the 1980-2000 periods are shown as follows: First, according to the two periods, the above mentioned data are correspondingly divided into two sub-samples: the 1950-1979 and the 1980-2000 sub-samples. The hypothesis of conditional convergence is tested in each sub-sample. Since the countries included have different steady states in each of the two periods because, among other things, they have different social infrastructures, as mentioned earlier, the regression results should show that the hypothesis of conditional convergence cannot be rejected in each sub-sample.

Next, because the regression results from using the data in the 1950-1979 sub-sample can supply an estimate of China's relative steady state for this period and those from using the data in the 1980-2000 sub-sample can provide an estimate of China's relative steady state for this period, a Wald test can be used to assess whether China's relative steady state changed significantly between the two periods.

For the results and the analyses, two approaches are used in this paper to test the hypothesis of conditional convergence in the 1950-1979 and the 1980-2000 sub-samples. Theoretically, both can lead to same conclusion, but actually the second one is preferred to the first one. They will be described, respectively. In addition, although data used are pool time series cross section data, it is assumed that there is heteroskedasticity across countries but no autocorrelation. Thus both approaches use GLS estimation.

IV.2.1. The first approach: using separate samples.

The hypothesis of conditional convergence is tested in the 1950-1979 and the 1980-2000 sub-samples, respectively. That is to say, the two estimates of China's relative steady state in the 1950-1979 and the 1980-2000 periods are obtained, respectively.

Section III has shown that equation (3.3) is used to test the hypothesis of conditional convergence. Since $(1/T)(1-e^{-\beta T}) \cong \beta$ and this paper takes the time interval $T = 1$ year, equation (3.3) can be rewritten as

$$\Delta y_{i,t} = c_i - \beta y_{i,t-1} + \varepsilon_{i,t} \tag{4.1}$$

According to the definition of conditional convergence, if the coefficient β in equation (4.1) is statistically positive (i.e., the speed of convergence is positive) and the constant term c_i, i.e., c (country i), differs significantly from 0 for most i (i.e., the countries included do not have the same steady state), the hypothesis of conditional convergence cannot be rejected in a given sample.

One can obtain the relevant information through the estimation of equation (4.1). Now make the null hypotheses that β is not statistically significant and c_i is not statistically significant (i.e., $H_0: \beta = 0$ and H_0: $c_i = 0$). All regression results from using the data in the 1950-1979 and the 1980-2000 sub-samples are shown in Appendix B, some of them are selected and displayed in Tables 1 and 2, respectively.

Table 1. Selected regression results from estimating equation (4.1) using the data in the 1950-1979 sub-sample

Method: GLS (Cross Section Weights)					
Included observations: 29					
Number of cross-sections used: 114					
Total panel observations: 2818					
Variable	Coefficient	Estimate	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta$	-0.080472	0.004873	-16.51316	0.0000
c (chn)	c (chn)	-0.138760	0.011867	-11.69339	0.0000
R-squared: 0.150948					

In Table 1, the p value of the t-statistic for the estimate of β is 0.0000, which implies that $H_0 : \beta = 0$ can be rejected at the 1% significance level in the 1950-1979 sub-sample. The estimate of β ($\hat{\beta} = 0.080472$) shows that β is statistically positive in this sub-sample. In Appendix B, according to the p values of the t-statistics for all estimates of c_i, for most countries, the estimate of c_i is statistically significant at the 1% significance level. Thus $H_0 : c_i = 0$ can be rejected at the 1% significance level in the 1950-1979 sub-sample, i.e., the constant term c_i is statistically significant in this sub-sample. The regression results for both β and c_i reveal that the hypothesis of conditional convergence cannot be rejected in the 1950-1979 sub-sample.

Table 2. Selected regression results from estimating equation (4.1) using the data in the 1980-2000 sub-sample

Method: GLS (Cross Section Weights)					
Included observations: 20					
Number of cross-sections used: 114					
Total panel observations: 2240					
Variable	Coefficient	Estimate	Std. Error	t-statistic	p value.
$y_{i,t-1}$	$-\beta$	-0.061884	0.004992	-12.39692	0.0000
c (chn)	c (chn)	-0.042170	0.008407	-5.016263	0.0000
R-squared: 0.239418					

In Table 2, the p value of the t-statistic for the estimate of β is 0.0000 and the estimate of β is 0.061884, which implies that β is statistically positive; in Appendix B, the regression results from using the data in the 1980-2000 sub-sample show that for most countries, the estimate of c_i is statistically significant at the 1% significance level, one can conclude that the constant term c_i is statistically significant. Thus the hypothesis of conditional convergence cannot be rejected in the 1980-2000 sub-sample.

It is not difficult to obtain an estimate of a country's relative steady state from the regression results of each sub-sample. As shown in regression equation (3.3), the constant term $c_i = (1/T)(1 - e^{-\beta T})\log(Y_i^* / \bar{Y}^*)$ for each i. Because $(1/T)(1 - e^{-\beta T}) \cong \beta$ holds when β is very small and the relative steady state of country i is $y_i^* = \log(Y_i^* / \bar{Y}^*)$, one can argue that $c_i = \beta\, y_i^*$ holds. Since the estimates of both c_i and β are available in the regression results, the estimate of y_i^* can be computed.

Now compute the estimates of China's relative steady states in the 1950-1979 and the 1980-2000 periods. Let the subscript 0 denote the 1950-1979 period and the subscript 1 denote the 1980-2000 period. Then β_0 denotes the convergence speed in the 1950-1979 period; β_1 denotes the convergence speed in the 1980-2000 period; c_0 (chn) denotes the constant term of China in the 1950-1979 period; c_1 (chn) denotes the constant term of China in the 1980-2000 period; y_0^* (chn) denotes China's relative steady state in the 1950-1979 period; y_1^* (chn) denotes China's relative steady state in the 1980-2000 period; and $\hat{Z}$ denotes the estimate of coefficient Z. Substituting the parameter estimates into the expression $y_i^* = c_i / \beta$, one obtains the following estimates of China's relative steady states in the two periods.

$$\hat{y}_0^* \text{(chn)} = \hat{c}_0 \text{(chn)}/\hat{\beta}_0 = -0.138760/0.080472 = -1.7243.$$

$$\hat{y}_1^* \text{(chn)} = \hat{c}_1 \text{(chn)}/\hat{\beta}_1 = -0.042170/0.061884 = -0.6814.$$

Both estimates have their own confidence intervals. Because there can be an overlap between the two confidence intervals and both y_0^* (chn) and y_1^* (chn) are possibly in the overlap, the gap between above $\hat{y}_0^*$ (chn) and $\hat{y}_1^*$ (chn) cannot be used to assess whether the change in China's relative steady state is significant. A Wald test is needed to assess that. One can do the Wald test easily if the two relative steady states, i.e., y_0^* (chn) and y_1^* (chn), are estimated in a joint sample.

IV.2.2. The second approach: using a joint sample.

The joint sample is the 1950-2000 sample that consists of both the 1950-1979 and the 1980-2000 sub-samples. After an introduction of dummy variables into equation (4.1), this joint sample can be used to test the hypothesis of conditional convergence in the 1950-1979 and the 1980-2000 sub-samples simultaneously. That is to say, the two estimates of China's relative steady state in the 1950-1979 and the 1980-2000 periods can be obtained simultaneously, after which one can do a Wald test to assess whether China's relative steady state changed significantly between the two periods.

Two dummy variables D_i and D_t are introduced into equation (4.1) to capture, respectively, the change in the constant term c_i and the change in the speed of convergence β between the 1950-1979 and the 1980-2000 periods. In fact, such an introduction of two dummy variables yields

$$\Delta y_{i,t} = c_{i,0} + \gamma_i D_i - \beta_0 y_{i,t-1} + \lambda D_t y_{i,t-1} + \varepsilon_{i,t}, \tag{4.2}$$

where D_i is the dummy variable of country *i*, D_i=1 for all *i* when data is in the 1980-2000 sub-sample and D_i= 0 for all *i* otherwise; D_t is the dummy variable of time period, D_t=1 when data is in the 1980-2000 sub-sample and D_t= 0 otherwise; $c_{i,0}$ denotes the constant term of country *i* in the 1950-1979 period; $c_{i,1}$(= $c_{i,0}+\gamma_i$) denotes the constant term of country *i* in the 1980-2000 period; β_0 denotes the speed of convergence in the 1950-1979 period; and β_1(=β_0-λ) denotes the speed of convergence in the 1980-2000 period. Equation (4.2) can be used to test the hypothesis of conditional convergence in the two sub-samples simultaneously. If β_0 in equation (4.2) is statistically positive and $c_{i,0}$ in equation (4.2) differs significantly from 0 for most *i*, the hypothesis of conditional convergence cannot be rejected in the 1950-1979 sub-sample. Similarly, if β_1 implied in equation (4.2) is statistically positive and $c_{i,1}$ implied in equation (4.2) differs significantly from 0 for most *i*, the hypothesis of conditional convergence cannot be rejected in the 1980-2000 sub-sample. One can use the data in the joint sample to estimate equation (4.2) to get the relevant information.

Now make the null hypotheses that β_0 is not statistically significant, $c_{i,0}$ is not statistically significant, β_1(=β_0-λ) is not statistically significant and $c_{i,1}$(=$c_{i,0}+\gamma_i$) is not statistically significant (i.e., $H_0:\beta_0=0$, $H_0:c_{i,0}=0$, $H_0:\beta_1=0$ and $H_0:c_{i,1}=0$). All regression results from estimating equation (4.2) are shown in Appendix B, some of them are displayed in Table 3.

Table 3. Selected regression results from estimating equation (4.2) using the data in the 1950-2000 sample

Method: GLS (Cross Section Weights)					
Included observations: 50					
Number of cross-sections used: 114					
Total panel observations: 5172					
Variable	Coefficient	Estimate	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta_0$	-0.080113	0.004383	-18.27622	0.0000
$D_i y_{i,t-1}$	λ	0.016589	0.009470	1.751723	0.0799
c_0 (chn)	c_0 (chn)	-0.138126	0.010814	-12.77258	0.0000
D(chn)	γ (chn)	0.091538	0.016694	5.483460	0.0000
R-squared: 0.173353					

In Table 3, the p value of the t-statistic for the estimate of β_0 is 0.0000. Thus H_0: $\beta_0 = 0$ is rejected at the 1% significance level. The estimate of β_0 ($\hat{\beta}_0 = 0.080113$) shows that β_0 is statistically positive. In Appendix B, according to the p values of the t-statistics for all estimates of $c_{i,0}$, for most countries, the estimate of $c_{i,0}$ is statistically significant at the 1% significance level. Thus H_0: $c_{i,0} = 0$ can be rejected at the 1% significance level. The regression results for both β_0 and $c_{i,0}$ show the hypothesis of conditional convergence cannot be rejected in the 1950-1979 sub-sample.

Although regression results from estimating equation (4.2) do not provide directly the information about whether β_1 and $c_{i,1}$ are statistically significant, Wald tests can be used to give the information. The results of the Wald test of $H_0 : \beta_1 = 0$ are shown in Table 4. Actually, Table 4 contains results of all Wald tests that are done in this paper. All Wald tests done in this paper are based on the estimates in Table 3 and on the assumption that there are no changes in the cross-sectional variances over time in the joint sample.

In Table 4, the results of the Wald test of $H_0 : \beta_1 = 0$ show that the p value for the Chi-square is 0.000000. Thus $H_0 : \beta_1 = 0$ can be rejected at the 1% significance level. The estimate of β_1 ($\hat{\beta}_1 = \hat{\beta}_0 - \hat{\lambda} = 0.063524$) shows that β_1 is statistically positive.

Table 4. Results of all Wald tests

Null Hypothesis: $\beta_1 = 0$			
Chi-square	57.26415	p value	0.000000
Null Hypothesis: c_1 (chn) = 0			
Chi-square	13.42046	p value	0.000249
Null Hypothesis: y_0^* (chn) = 0			
Chi-square	335.3730	p value	0.000000
Null Hypothesis: y_1^* (chn) = 0			
Chi-square	34.73508	p value	0.000000
Null Hypothesis: y_1^* (chn) - y_0^* (chn) = 0			
Chi-square	40.31427	p value	0.000000

The Wald test of H_0: $c_{i,1} = 0$ can be made on a country by country basis, but such a job is not done in this paper because there are too many countries included in the sample. Since most estimates of $c_{i,0}$ are significant at the 1% significance level while most estimates of γ_i are not significant at this significance level (the p values are shown in Appendix B), one can, to a very large extent, believe that most estimates of $c_{i,1}$ $(= c_{i,0} + \gamma_i)$ are statistically significant. Thus the results of the Wald test of H_0: $c_{i,1} = 0$ should show that H_0: $c_{i,1} = 0$ can be rejected. The regression results for both β_1 and $c_{i,1}$ suggest the hypothesis of conditional convergence cannot be rejected in the 1980-2000 sub-sample.

The regression results from estimating equation (4.2) show directly that both c_0 (chn) and γ (chn) are statistically significant at the 1% significance level. Actually, the estimate of c_0 (chn) ($\hat{c}_0$ (chn) = -0.138126) shows that c_0 (chn) is statistically negative and the estimate of γ (chn) ($\hat{\gamma}$ (chn) = 0.091538) shows that γ (chn) is statistically positive. Similarly, regression results from estimating equation (4.2) do not provide direct information about whether c_1 (chn) $(= c_0$ (chn) $+ \gamma$ (chn)) is statistically significant, but a Wald test can be used to test an hypothesis. Now make the null hypothesis that c_1 (chn) is not statistically significant (i.e., H_0: c_1 (chn) = 0). The results of the Wald test of H_0: c_1 (chn) = 0 are shown in Table 4, and one can find the p value for Chi-square is 0.000249, which implies that H_0: c_1 (chn) = 0 can be rejected at the 1% significance level. The estimate of c_1 (chn) ($\hat{c}_1$ (chn) = $\hat{c}_0$ (chn) + $\hat{\gamma}$ (chn) = -0.046588) shows that c_1 (chn) is statistically negative.

Using the regression results from estimating equation (4.2) and the formula $y_i^* = c_i / \beta$, one can easily compute the estimates of China's relative steady state in the two periods:

$$\hat{y}_0^* \text{ (chn)} = \hat{c}_0 \text{ (chn)}/ \hat{\beta}_0 = C(24)/(-C(1)) = -1.7241,$$

$$\hat{y}_1^* \text{ (chn)} = \hat{c}_1 \text{ (chn)}/ \hat{\beta}_1 = (C(24) + C(138))/(-C(1) - C(2)) = -0.7334.$$

According to $y_i^* = \log(Y_i^* / \bar{Y}^*)$, a country's relative steady state will equal the zero if its steady state is the same as the average steady state. One can determine whether or not China's steady state differs from the average by testing whether its relative steady state equals zero. The results of the Wald tests of the null hypotheses that y_0^* (chn) = 0 and y_1^* (chn) = 0) are shown in Tables 4. One can find that the p value for the Chi-square is 0.000000 in each of the two Wald tests, which implies that the null hypotheses that y_0^* (chn) = 0 and y_1^* (chn) = 0 can be rejected at the 1% significance level. The estimates of y_0^* (chn) and y_1^* (chn) ($\hat{y}_0^*$ (chn) = -1.7241 and $\hat{y}_1^*$ (chn) = -0.7334.) show that both y_0^* (chn) and y_1^* (chn) are statistically negative. That is to say, China's relative steady state in each of the two periods is below the average (zero value), and so is China's steady state. Thus China is typically a less developed country.

Although the estimates of equation (4.1) and equation (4.2) lead to the same conclusion that the hypothesis of conditional convergence cannot be rejected in both the 1950-1979 and the 1980-2000 samples, it is important to examine the difference between regression results for equation (4.1) and those for equation (4.2). The regression results for the 114 countries can be found in Appendix B. Since China is the focus of the analysis of this paper, here only regression results pertaining to China are compared. Such a comparison is made in Table 5.

Table 5. A comparison of the regression results for China.

Coefficients	Estimates obtained from estimating equation (4.1)	Estimates obtained from estimating equation (4.2)
β_0	0.080472	0.080113
β_1	0.061884	0.063524
c_0 (chn)	-0.138760	-0.138126
c_1 (chn)	-0.042170	-0.046588
y_0^* (chn)	-1.7243	-1.7241
y_1^* (chn)	-0.6814	-0.7334

Table 5 shows that estimates obtained from estimating equation (4.1) are not identical to those obtained from estimating equation (4.2). The reason for these small differences is that the estimation of equation (4.2) is based on the assumption that there are no changes in the cross-sectional variances over time in the joint sample while the two separate estimations of equation (4.1) permit the cross-sectional variances to be different in the two sub-samples. Whether these small differences are statistically significant or not are testable hypotheses in their own right. One can ignore these small differences because it is reasonable to believe that they are not statistically significant.

Using the estimates of equation (4.2), one tests the null hypothesis that the change in y^* (chn) is not statistically significant. The results of the Wald test of $H_0: y_1^*$ (chn) - y_0^* (chn) = 0 are shown in Table 4. The p value for Chi-square is 0.000000 in the Wald test of $H_0: y_1^*$ (chn) - y_0^* (chn) = 0, which implies that the null hypothesis that the change in y^* (chn) is not statistically significant can be rejected at the 1% significance level.

Although one has just assessed that China's relative steady state y^* (chn) changed at the 1% significance level between the 1950-1979 and the 1980-2000 periods, one needs to know whether the change in y^* (chn) is positive or negative. From the estimates of y_0^* (chn) and y_1^* (chn) ($\hat{y}_0^*$ (chn) = -1.7241 and $\hat{y}_1^*$ (chn) = -0.7334.), one can conclude that the change in y^* (chn) is positive. Thus one can draw a conclusion that China's relative steady state y^* (chn) increased between the two periods.

V. One explanation for the improvement in China's relative steady state

China's relative steady state improved significantly between the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period). Why could it improve? One explanation for this is that China's social infrastructure has improved significantly during its reform period, and that an improvement in China's social infrastructure may have caused an improvement in China's steady state. [13]

The People's Republic of China (hereinafter referred to as China) has existed for over 50 years since it was founded in 1949 by Chinese communists. After Chinese communists gained full control of the country's government, they built a planned and nearly closed Chinese economy according to communist theory. This situation did not change until the end of the 1970s. When the famous Chinese leader Deng XiaoPing came to power in 1979, he and his partners launched a meaningful reform and established new economic policies which caused China's economy to change fundamentally.

Consequently, since 1979 China's economy has been changing from a planned and nearly closed economy toward an open and market oriented one. This point has been noted in numerous studies. For example, Wei (1999) shows that since the launch of the economic reform at the end of the 1970s, China's development policies have changed from the ones based on self-reliance to open-door policies. Liu and Yoon (2000) point out that China's economic reform starting at the end of the 1970s, especially its urban reform announced in 1984, has decentralized Chinese government control over the Chinese economy and encouraged free trade. Yao and Zhang (2001) argue that China has experienced rapid growth during the last two decades of the 20th century due to the economic reform and the open-door policy articulated by Chinese leader Deng XiaoPing at the end of the 1970s. Bao, Chang, Sachs, and Woo (2002) indicate that the Chinese reform which started in 1979 has widely been regarded as a success, and the structure of the Chinese economy has, during this reform, experienced a fundamental change towards a market oriented system. As for China's economic system, Weeks and Yao (2003) argue that China has been subject to two contrasting economic systems since the establishment

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[13] In reality, among a broad set of countries, most of them do not experience changes in their steady states, thus an improvement in a country's steady state can cause an improvement in its relative steady state.

of The People's Republic of China in 1949. Before 1979 China was a closed economy under centralized planning. After that year China adopted market oriented economic reform and an open-door policy, and as a result, China has experienced spectacular growth rates during the last twenty years. Wang, Barreto and Zou (2004) demonstrate that China has been the second largest recipient of foreign direct investment, and has achieved an impressive record of rapid growth of its GDP, at an average annual rate of about 10% during its reform period. They think all these achievements are owed to China's open-door policy and market oriented economic reform which started in 1979. The above economists agree that China's economic reform starting at the end of 1970s has caused a meaningful change in China's economic system and China has experienced spectacular growth rates during its economic reform. Thus it is reasonable to believe that China's social infrastructure has been improved significantly due to its economic reform.

As discussed in section II, a country's social infrastructure determines, to a large extent, its steady state. Thus an improvement in China's social infrastructure can result in an increase in China's steady state. Because social infrastructure affects an economy's steady state through its effects on economic parameters, it is necessary to verify the changes in relevant economic parameters. According to economic growth theory, these economic parameters are the saving rate s, the rate of population growth n, the capital depreciation rate δ and the rate of technological progress g. In this paper, since the regression equation used to test the hypothesis of conditional convergence has assumed that all countries have the same and constant capital depreciation rate δ and the rate of technological progress g, one can only check whether there are changes in the saving rate and the population growth rate of China. In the following, they will be checked one by one.

Since economic growth theory is based on the Solow model and the Solow model assumes that the saving rate equals the investment share (i.e., $s = I/Y$), one should check the investment share of China instead. The data on the investment share of China were downloaded from the Penn World Table version 6.1 (http://datacentre2.chass.utoronto.ca/pwt/). Figure (5.1) is constructed using these data.

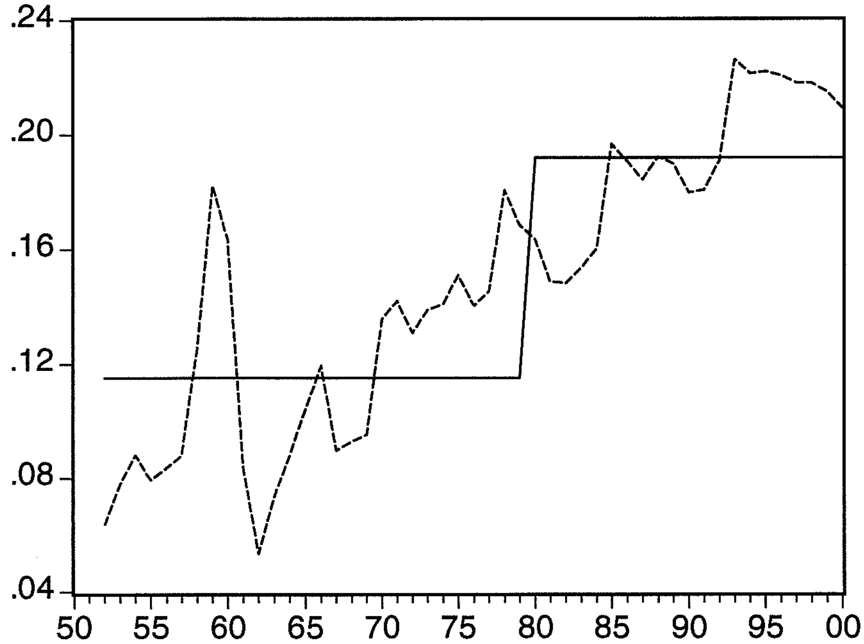

Figure (5.1) The investment share of China (the line of dashes) in the 1950-2000 period and the two means (the solid line) in the 1950-1979 and the 1980-2000 periods

Figure (5.1) show that the mean investment share of China in the 1980-2000 period is obviously higher than the mean in 1950-1979. In fact, the two arithmetical means in the 1950-1979 and the 1980-2000 periods are 0.1153 and 0.1920, respectively. According to economic growth theory, an increase in the saving rate of China (i.e. an increase in the investment share of China) can lead to an increase in China's steady state.

As for the information shown in Figure (5.1), two questions may be raised. First, as the line of dashes shows, the investment share of China around 1959 jumps up so much that it nearly reaches the mean investment share of China in the 1980-2000 period. How can one explain this? It is well known that around 1959 China suffered a severe famine caused by the activities in the Great Leap Forward. The starvation was so heavy that it caused at least 30 million Chinese deaths because of excessively low consumption. In fact, the consumption of those who survived in the Great Leap Forward was much below the normal level. Thus China's consumption around 1959 declined heavily. For a closed economy, $(Y\text{-}C\text{-}G)/Y = I/Y = s$ holds, so a huge increase in s will happen as long as there is a large decrease in $(C + G)/Y$. China's C decreased so heavily around 1959 that it could have caused $(C + G)/Y$ to decrease sharply even though China's C and Y decreased simultaneously around that year. This can explain why the investment share of China around 1959 increased by so much. It is conceivable that the investment share of China around 1959 would be about 0.10 if China had experienced normal conditions around that year.

Second, why is the mean investment share of China in the 1980-2000 period much higher than the mean in the 1950-1979 period? One reason is that China's economy was, to a large extent, an open one in the 1980-2000 period; but nearly a closed one in the 1950-1979 period. China attracted a huge amount of foreign investment in the 1980-2000 period but it had almost no foreign investment in the 1950-1979 period. Although China's GDP increased at a much higher average annual rate in the 1980-2000 period than it did in the 1950-1979 period, the foreign investment made in China in the 1980-2000 period was so large that it could allow the mean investment share of China in the 1980-2000 period to be at a higher level. This can explain why the mean investment share of China in the 1980-2000 period is much higher than the mean in the 1950-1979 period.

Next, one can check whether the population growth rate of China changed between the two periods. The Penn World Table 6.1(http: //datacentre2.chass.utoronto.ca/ pwt/) does not provide directly data on the population growth rate of China, but it provides the data on the population of China. Figure (5.2) is constructed using the downloaded data on the population of China in the 1950-2000 period. Furthermore, using the data on the population of China, one can compute both the annual population growth rate of China[14] in the 1950-2000 period and the two arithmetical means in the 1950-1979 and the 1980-2000 periods. After finishing all the required computations, one can draw Figure (5.3) that shows both the annual population growth rate of China in the 1950-2000 period and the two means in the 1950-1979 and the 1980-2000 periods.

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[14] As for the computations, one can make an assumption that the observation of the population of china in year t is the one at the end of that year for all t, t is in the 1950-2000 period, then the population growth rate of China in year t is given by (the population of China in year t minus the population of China in year t-1) /the population of China in year t-1. In this way, one can compute the population growth rate of China in year t, t is in the 1950-2000 period.

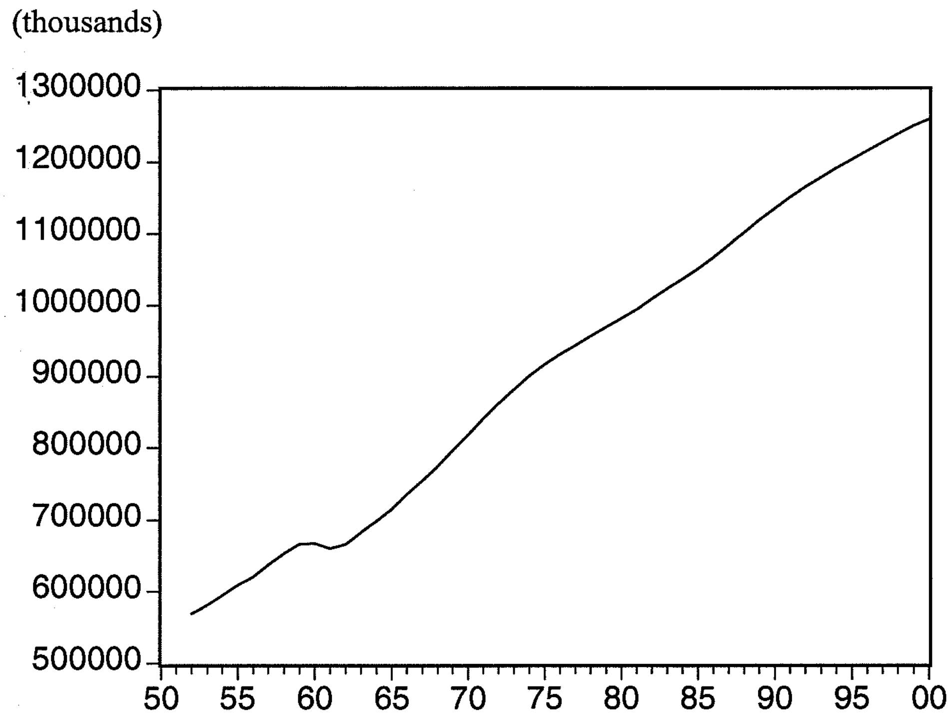

Figure (5.2) The population of China in the 1950-2000 period

Figure (5.3) The annual population growth rate of China (the line of dashes) in the 1950-2000 period and the two means (the solid line) in the 1950-1979 and the 1980-2000 periods

Figure (5.2) shows that the population of China kept increasing during the 1950-2000 period except around 1959 (the severe famine in China around 1959 resulted in a decline in the population of China and a negative population growth rate of China around this year.). But Figure (5.3) reveals that the population growth rate of China did not. In Figure (5.3), the mean population growth rate of China in the 1980-2000 period is obviously lower than the mean in the 1950-1979 period. In fact, the two arithmetical means in the 1950-1979 and the 1980-2000 periods are 2.51% and 1.42%, respectively. According to economic growth convergence theory, a decrease in the population growth rate of China can lead to an increase in China's steady state.

Why is the mean population growth rate of China in the 1980-2000 period much lower than the mean in the 1950-1979 period? The main reason is the policy of family planning that has been widely used in China since the end of the 1970s. Although this policy may be unrelated to China's economic reform, the execution of this policy did prove an improvement in China's social infrastructure because China's policy of population surely belongs to China's social infrastructure.

In the 1950-1979 period, the Chinese government wrongly believed that a large population could increase both China's strength and safety in the world. It therefore encouraged young Chinese couples to bear children. Many young Chinese couples in this period, especially those in China's countryside, answered the Chinese government's call by bearing four or more children, which resulted in a rapid increase in the population of China during this period. From Figure (5.2), one can see that the population of China increased by nearly 80% during the 1950-1979 period.

At the end of the 1970s, the Chinese government realized that the population of China had become so large that it played a heavily negative role in China's economic development. In fact, such a large population is a heavy burden not only to China but also to the world. Furthermore, such a large population can result in a huge disaster for China (even for the world) if it continues to grow at a relatively high rate. Therefore, ignoring moral considerations, the Chinese government decided to implement a policy of family planning, the aim of which is to reduce the population growth rate of China and ultimately reduce the population of China. In the 1980-2000 period, the policy of family planning required that each young Chinese couple in all of China's cities bear only one child, and each young Chinese couple in China's countryside bear at most two children. In general, this policy was used successfully in China and it did lead to the outcome that the Chinese government expected. That is to say, it has reduced the population growth rate of China, and ultimately it can reduce the population of China.

Because there have been some improvements in China's social infrastructure during its reform period, it is reasonable to believe that these improvements in China's social infrastructure caused, in general, an increase in the investment share of China (i.e., the saving rate of China) and a decrease in the population growth rate of China between the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period). These improvements in China's social infrastructure can cause an improvement in China's steady state through their effects on the saving rate and the population growth rate of China. The details are shown in Figure (5.4).

Figure (5.4) shows the effects of an increase in the saving rate of China $s(chn)$ and a decrease in the population growth rate of China $n(chn)$ on China's steady state $k^*(chn)$. In Figure (5.4), one can see that both an increase in the saving rate of China $s(chn)$ and a decrease in the population growth rate of China $n(chn)$ can result in an improvement in China's steady state $k^*(chn)$, thus an improvement in the steady state value of China's real GDP per capita $Af\left(k^*(chn)\right)$ at given A.

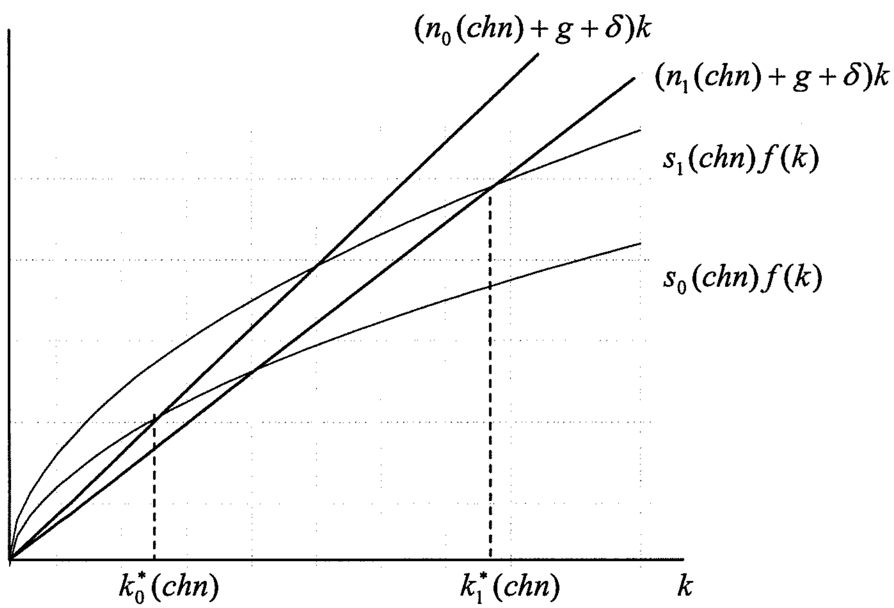

Figure (5.4)

VI. A comparison of China's relative steady state to those of some other countries

In order to identify the gaps between China's relative steady state and those of some other countries, a comparison between them is necessary. Such a comparison is made just using the estimates of the relative steady states of selected countries.

The selected countries consist of the developed countries and some of the less developed ones. This is because there are too many less developed countries whose constant terms (i.e., their fixed effects) changed at the 5% or 10% significance level. This paper only selects the less developed countries whose constant terms changed at the 1% significance level between the 1950-1979 and the 1980-2000 periods.

According to regression results from estimating equation (4.2), γ_i is significant at the 1% significance level for twenty-six countries, so there are twenty-six countries whose constant terms c_i (i.e., their fixed effects) changed at the 1% significance level between the 1950-1979 and the 1980-2000 periods. The twenty-six countries consist of five developed and twenty-one less developed countries. The five developed are France, Greece, Ireland, Sweden and Switzerland; the twenty-one less developed are Bolivia, Botswana, Cape Verde, China, Cote d'Ivoire, Costa Rica, Ecuador, El Salvador, Guatemala, India, Indonesia, South Korea, Mexico, Mozambique, Namibia, Nicaragua, Peru, South Africa, Taiwan, Thailand and Venezuela. The regression results also show that the change in the speed of convergence β is not significant because λ is not significant at the 5 % significance level. In section IV, a Wald test has been made to show China's relative steady state changed at the 1% significance level. Wald tests can also be made to assess whether the other twenty-five countries' relative steady states changed. Generally, one can believe their relative steady states should have changed at the 1% or 5 % significance level.

In this paper, the estimates of the relative steady states of the developed countries (including the above five developed ones) and the above twenty one less developed countries are computed. As shown earlier, y_i^* denotes the relative steady state of country i, $y_i^* = c_i / \beta$, the subscript 0 denotes the 1950-1979 period, the subscript 1 denotes the 1980-2000 period, $y_0^* = c_0 / \beta_0$ and $y_1^* = c_1 / \beta_1$. From the regression results from estimating equation (4.2), one can obtain the estimates of the relative steady states of selected countries. They are shown in Tables 6 and 7, respectively.

Table 6. Estimates of the relative steady states of the developed countries

Country	1950-1979	1980-2000
Australia	1.0653	1.0105
Austria	1.0184	0.9491
Belgium	0.9958	0.9399
Canada	1.1507	1.0496
Denmark	1.1859	1.0559
Finland	0.9626	0.9387
France	**1.0358**	**0.8781**
Germany	0.9245	0.9043
Greece	**0.6720**	**0.3645**
Iceland	1.0479	1.0108
Ireland	**0.5090**	**1.0599**
Italy	0.9502	0.8978
Japan	0.9964	1.0667
Luxembourg	1.2379	1.6726
Netherland	1.0798	0.9474
Norway	1.0765	1.1956
New Zealand	0.9590	0.7039
Spain	0.7536	0.6524
Sweden	**1.1491**	**0.9106**
Switzerland	**1.3578**	**1.0645**
United Kingdom	0.9589	0.9067
United States	1.3182	1.2803

Note : Estimates of the relative steady states of France, Greece, Ireland, Sweden and Switzerland are bold. The five developed countries should have experienced changes in their relative steady states at the 1% or 5% significance level between the 1950-1979 and the 1980-2000 periods because their constant terms (i.e., their fixed effects) changed at the 1% significance level between the two periods.

Table 6 shows that the estimates of the relative steady states of the above developed countries are all positive and actually around 1. Among the developed countries listed in Table 6, at the 1% or 5% significance level, Ireland should have experienced an increase in its relative steady state, France, Greece, Sweden and Switzerland should have experienced decreases in their relative steady states, and other developed countries probably did not experience changes in their relative steady states between the 1950-1979 and the 1980-2000 periods. One explanation for this is that the five above mentioned developed countries' social infrastructures changed significantly while other developed countries' social infrastructures did not between the two periods.

Table 7. Estimates of the relative steady states of the twenty one less developed countries whose constant terms (i.e., their fixed effects) changed at the 1% significance level between the 1950-1979 and the1980-2000 periods.

Country	1950-1979	1980-2000
Bolivia	-0.6471	-1.4223
Botswana	-0.7517	-0.0883
Cape Verde	-1.4617	-0.5312
China	-1.7241	-0.7334
Cote d'Ivoire	-0.5073	-1.9539
Costa Rica	0.0118	-0.6756
Ecuador	-0.3720	-1.1177
El Salvador	-0.1395	-1.0447
Guatemala	-0.3901	-0.9671
India	-1.5461	-1.2094
Indonesia	-1.5090	-0.6650
South Korea	-0.3318	0.6799
Mexico	0.2406	-0.1019
Mozambique	-1.2145	-2.6165
Namibia	0.2026	-1.0348
Nicaragua	-0.2009	-1.9277
Peru	-0.0152	-0.9150
South Africa	0.3045	-0.2960
Taiwan	-0.1773	0.9847
Thailand	-0.8850	-0.1981
Venezuela	0.2787	-0.4468

Among the forty-two estimates in Table 7, three (the estimates of Costa Rica and Peru in the 1950-1979 period and the estimate of Botswana in the 1980-2000 period) are much probably not significant, six (the estimates of Mexico, Namibia, South Africa and Venezuela in the 1950-1979 period and the estimates of South Korea and Taiwan in the 1980-2000 period) are positive, others are negative.

The twenty-one less developed countries listed in Table 6 should have experienced changes in their relative steady states at the 1% or 5% significance level between the

1950-1979 and the1980-2000 periods because their constant terms (i.e., their fixed effects) changed at the 1% significance level between the two periods. According to the estimates in the two periods, eight countries should have experienced increases in their relative steady states: Botswana, Cape Verde, China, India, Indonesia, South Korea, Taiwan and Thailand. Thirteen countries should have experienced decreases: Bolivia, Cote d'Ivoire, Costa Rica, Ecuador, El Salvador, Guatemala, Mexico, Mozambique, Namibia, Nicaragua, Peru, South Africa, Venezuela. One explanation for this is that the social infrastructures of the eight and the thirteen countries improved and worsened, respectively, between the 1950-1979 and the1980-2000 periods

The estimates for China in the 1950-1979 and the 1980-2000 periods are -1.7241 and -0.7334, respectively. It is clear that China's relative steady state increased greatly between the two periods. This means that the gap between China's relative steady state and those of developed countries has been reduced greatly. However, the estimate for China in the 1980-2000 period is still negative, i.e., below the average (zero value), thus far below the typical level of the estimates of developed countries, which is around 1 as shown in Table 6. Clearly, there is still a long way to go for China's relative steady state to catch up with those of developed countries even if it can continue to increase in the future.

In Table 7, one can notice that the estimates of several countries are significantly negative in one period but become significantly positive in another. For example, the estimates of the relative steady states of South Korea and Taiwan are significantly negative (-0.3318, -0.1773) in the 1950-1979 period but are significantly positive (0.6799, 0.9847) in the 1980-2000 period. In fact, the two countries' relative steady states in the 1980-2000 period have reached the level of developed countries. Thus one can regard South Korea and Taiwan as two examples where a country's relative steady state increases from a less developed country's level to a developed country's level. Such changes in their relative steady states are meaningful because they can be regarded as developed countries in the 1980-2000 period if one judges only by the estimates of their relative steady states in this period. Many are interested in whether same thing can happen to China's relative steady state in the future. Unfortunately, at present there is no certain answer to this question.

VII. Conclusions

This paper presents a study of whether China's relative steady state changed between the 1950-1979 period (pre-reform period) and the 1980-2000 period (reform period). According to the results and analyses in the previous sections, one can draw the following conclusions.

First, China's relative steady state improved significantly between the 1950-1979 period (per-reform period) and the 1980-2000 period (reform period).

Second, although China's relative steady state improved significantly, China's relative steady state is still negative, i.e., below the average (zero value), the gap between China's relative steady state and those of the developed countries is still large. It is reasonable to believe that it will take a long time for China's relative steady state to reach the typical level of those of the developed countries even if it can keep rising.

Third, there are many possible explanations for the improvement in China's relative steady state between the two periods. Among the possible explanations, the most valuable one that this paper suggests is that China's social infrastructure has improved significantly during its reform period (such as the fundamental change in China's economic system and the execution of a policy of family planning in China). A country's social infrastructure determines, to a large extent, its steady state, so an improvement in a country's social infrastructure can result in an improvement in its steady state, thus an improvement in its relative steady state. China's economy was a planned and nearly closed one with a high population growth rate in the 1950-1979 period, which clearly means China had a poor social infrastructure in this period. This can explain, to a large extent, why China's steady state and relative steady state were both very low in this period. Although China's economy started to shift toward an open and market oriented one and began to adopt a policy of family planning to reduce its population growth rate at the end of the 1970s, and both surely mean a significant improvement in China's social infrastructure in the 1980-2000 period (reform period), unfortunately, China's social infrastructure is still not as good as the developed countries' social infrastructure even at the end of the 20th century. This can explain, to a large extent, why China's relative steady state in the 1980-2000 period is still far below the typical level of those of developed countries. In order for China's relative steady state to improve further, China's social infrastructure should improve further.

Fourth, this paper also suggests that whether China's relative steady state can improve further depends on whether the saving rate of China can increase and the population growth rate of China can decrease further. These two changes depend, in turn, on whether China's social infrastructure can improve further.

Fifth, among the one hundred and fourteen countries included in the analysis, there are twenty-six countries (they are shown in section VI.) whose constant terms (i.e., their fixed effects) changed at the 1% significance level between the 1950-1979 and the 1980-2000 periods. Because the change in the speed of convergence between the two periods is not significant at the 5% significance level, the twenty-six countries should have experienced changes in their relative steady states at the 1% or 5% significance level between the two periods. Among the twenty-six countries, nine countries (they are shown in section VI.) should have enjoyed improvements in their relative steady states while seventeen ones (they are shown in section VI.) should have suffered declines in their relative steady states. One explanation for this is that the social infrastructures of the nine and the seventeen countries improved and worsened, respectively, between the two periods.

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Penn World Table version 6.1 (http://datacentre2.chass.utoronto.ca/pwt/).

Appendix A. Two name lists of all used countries

1. The name list of developed countries:

Australia
Austria
Belgium
Canada
Denmark
Finland
France
Germany
Greece
Hong Kong
Iceland
Ireland
Israel
Italy
Japan
Luxembourg
Netherlands
Norway
New Zealand
Singapore
Spain
Swede
Switzerland
United Kingdom
USA

2. The name list of less developed countries:
Algeria
Angola
Argentina
Bangladesh
Barbados
Benin
Bolivia
Botswana
Brazil.
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Chile

China
Comoros
Congo, Republic of
Con, Dem. Rep.
Colombia
Costa Rica
Cote d'Ivoire
Cyprus
Dominica, Republic of
Ecuador
Egypt
Fiji
El Salvador
Equatorial Guinea
Ethiopia
Gabon
Gambia
Ghana
Guatemala
Guinea
Guyana
Haiti
Honduras
India
Indonesia
Iran
Jamaica
Jordan
Kenya
Korea, Republic of
Lesotho
Madagascar
Malawi
Malaysia
Mali
Mauritania
Mauritius
Mexico
Morocoo
Mozambique
Namibia
Nepal
Nicaragua
Niger
Nigeria
Pakistan

Panama
Papua New Guinea
Paraguay
Peru
Philippines
Portugal
Puerto Rico
Romania
Rwanda
Senegal
Seychelles
Sierra Leone
South Africa
Sri Lanka
Syria
Taiwan
Tanzania
Thailand
Togo
Trinidad & Tobago
Tunisia
Turkey
Uganda
Uruguay
Venezuela
Zambia
Zimbabwe

Note: Data for above listed countries, which are downloaded from the Penn World Table version 6.1 (http://datacentre2.chass.utoronto.ca/pwt/), are actually an unbalanced panel. This is because the data for some countries are not available for a few year in the 1950-2000 period. These countries are Angola, Barbados, Cape Verde, Comoros, Cote d'Ivoire, Germany, Guatemala, Guyana, Israel, Lesotho, Mauritius, Malawi, Papua New Guinea, Puerto Rico, Senegal, Seychelles, Sierra Leone, Trinidad & Tobago, Uganda, etc.

Appendix B. The outputs of Eviews (an economic software used in Univ. of Ottawa)

1. Regression results from estimating equation (4.1) using the data in the 1950-1979 sample

Dependent Variable: D(Y?)
Method: GLS (Cross Section Weights)
Date: 03/05/05 Time: 14:53
Included observations: 29
Number of cross-sections used: 114
Total panel (unbalanced) observations: 2818
Convergence achieved after 5 iteration(s)
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y?(-1)	-0.080472	0.004873	-16.51316	0.0000
ALG--C	-0.019662	0.044544	-0.441409	0.6590
ANG--C	-0.077692	0.038457	-2.020247	0.0435
ARG--C	0.048118	0.011354	4.237815	0.0000
AUS--C	0.085715	0.007443	11.51613	0.0000
AUT--C	0.081828	0.007584	10.78899	0.0000
BAN--C	-0.144595	0.022324	-6.477084	0.0000
BARB--C	0.065220	0.012312	5.297143	0.0000
BEL--C	0.080062	0.006250	12.80923	0.0000
BEN--C	-0.129069	0.015949	-8.092613	0.0000
BOL--C	-0.052029	0.013724	-3.791062	0.0002
BOTS--C	-0.060631	0.020402	-2.971749	0.0030
BRA--C	-0.002731	0.005710	-0.478338	0.6324
BURK--C	-0.165935	0.021901	-7.576471	0.0000
BURU--C	-0.153423	0.030775	-4.985319	0.0000
CAM--C	-0.096891	0.015625	-6.201091	0.0000
CAN--C	0.092555	0.006383	14.50135	0.0000
CAPE--C	-0.117565	0.025037	-4.695735	0.0000
CAR--C	-0.102585	0.023991	-4.275963	0.0000
CDR--C	-0.136981	0.021828	-6.275570	0.0000
CHAD--C	-0.119132	0.027540	-4.325791	0.0000
CHI--C	-0.000410	0.016256	-0.025236	0.9799
CHN--C	-0.138760	0.011867	-11.69339	0.0000
COL--C	-0.028253	0.004528	-6.239423	0.0000
COM--C	-0.073766	0.022285	-3.310093	0.0009
CON--C	-0.101218	0.067339	-1.503120	0.1329
COTE--C	-0.040834	0.013255	-3.080607	0.0021
CR--C	0.000900	0.008789	0.102406	0.9184
CYP--C	0.015411	0.020455	0.753444	0.4512
DEN--C	0.095385	0.008310	11.47783	0.0000
DOM--C	-0.055295	0.016913	-3.269298	0.0011
ECUA--C	-0.030012	0.009913	-3.027591	0.0025
EGY--C	-0.069074	0.008750	-7.894064	0.0000
EQU--C	-0.076835	0.050111	-1.533305	0.1253
ES--C	-0.011220	0.007472	-1.501538	0.1333
ETHI--C	-0.165089	0.012603	-13.09874	0.0000
FIJI--C	-0.030591	0.017432	-1.754900	0.0794
FIN--C	0.077368	0.009337	8.285776	0.0000
FRA--C	0.083263	0.005803	14.34779	0.0000
GAB--C	0.067166	0.027760	2.419510	0.0156
GAM--C	-0.105643	0.016792	-6.291349	0.0000
GER--C	0.074396	0.004584	16.23114	0.0000

→ $\hat{\beta}_0 = 0.080472$ (Y?(-1))

→ $\hat{c}_0(\text{chn}) = -0.138760$ (CHN--C)

GHA--C	-0.105056	0.013702	-7.667209	0.0000
GRE--C	0.053928	0.005554	9.710631	0.0000
GUAT--C	-0.031397	0.004337	-7.239782	0.0000
GUIN--C	-0.166448	0.025633	-6.493460	0.0000
GUY--C	-0.047678	0.040041	-1.190756	0.2339
HAI--C	-0.154502	0.009616	-16.06643	0.0000
HK--C	0.061677	0.007341	8.402172	0.0000
HON--C	-0.075298	0.008162	-9.225615	0.0000
ICE--C	0.084224	0.010031	8.396486	0.0000
INDI--C	-0.124416	0.011332	-10.97885	0.0000
INDO--C	-0.121476	0.014885	-8.161097	0.0000
IRAN--C	0.008253	0.026307	0.313720	0.7538
IRE--C	0.040901	0.007363	5.555149	0.0000
ISR--C	0.050194	0.012368	4.058284	0.0001
ITA--C	0.076344	0.005569	13.70856	0.0000
JAM--C	-0.029489	0.014656	-2.012072	0.0443
JAP--C	0.079975	0.007713	10.36902	0.0000
JOR--C	-0.046359	0.044257	-1.047504	0.2950
KEN--C	-0.120960	0.015704	-7.702492	0.0000
KORE--C	-0.026846	0.007737	-3.469855	0.0005
LESO--C	-0.112644	0.019864	-5.670884	0.0000
LUX--C	0.099574	0.020969	4.748660	0.0000
MAD--C	-0.133599	0.007842	-17.03690	0.0000
MAIL--C	-0.167077	0.022928	-7.286946	0.0000
MAL--C	-0.165985	0.014087	-11.78261	0.0000
MALA--C	-0.028029	0.015701	-1.785240	0.0743
MAU--C	-0.087322	0.050374	-1.733464	0.0831
MAUR--C	-0.003838	0.021470	-0.178787	0.8581
MEX--C	0.019305	0.005331	3.621139	0.0003
MOR--C	-0.057783	0.010024	-5.764469	0.0000
MOZA--C	-0.097558	0.015543	-6.276536	0.0000
NAMI--C	0.016310	0.004206	3.877476	0.0001
NEP--C	-0.158975	0.009032	-17.60052	0.0000
NETH--C	0.086832	0.007524	11.54093	0.0000
NICA--C	-0.016158	0.017577	-0.919280	0.3580
NIG--C	-0.143360	0.035646	-4.021795	0.0001
NIGE--C	-0.123343	0.034710	-3.553577	0.0004
NOR--C	0.086555	0.006001	14.42371	0.0000
NZ--C	0.077199	0.013478	5.727853	0.0000
PAK--C	-0.124932	0.010143	-12.31740	0.0000
PANA--C	-0.019868	0.005918	-3.357303	0.0008
PARA--C	-0.046232	0.006068	-7.619146	0.0000
PERU--C	-0.001256	0.007692	-0.163271	0.8703
PHI--C	-0.044745	0.006419	-6.970769	0.0000
PNG--C	-0.027854	0.009644	-2.888330	0.0039
PORT--C	0.029651	0.006081	4.875879	0.0000
PUE--C	0.038693	0.008423	4.593496	0.0000
ROM--C	-0.018313	0.006969	-2.627668	0.0086
RWAN--C	-0.162662	0.016445	-9.891444	0.0000
SA--C	0.024476	0.004861	5.034742	0.0000
SENE--C	-0.118413	0.011563	-10.24077	0.0000
SEY--C	-0.011095	0.019662	-0.564257	0.5726
SIER--C	-0.123401	0.015996	-7.714725	0.0000
SING--C	0.052812	0.044101	1.197509	0.2312
SPA--C	0.060507	0.007965	7.596829	0.0000

SRI--C	-0.094673	0.013814	-6.853283	0.0000
SWE--C	0.092431	0.007294	12.67207	0.0000
SWI--C	0.109229	0.009383	11.64110	0.0000
SYR--C	-0.029415	0.045655	-0.644292	0.5194
TAIW--C	-0.014468	0.008825	-1.639413	0.1012
TAN--C	-0.170225	0.012236	-13.91208	0.0000
THAI--C	-0.071291	0.012336	-5.779045	0.0000
TOGO--C	-0.120465	0.157599	-0.764373	0.4447
TRIN--C	0.044970	0.014740	3.050810	0.0023
TUNI--C	-0.034302	0.008039	-4.266671	0.0000
TURK--C	-0.011159	0.009809	-1.137726	0.2553
UGA--C	-0.183201	0.018621	-9.838361	0.0000
UK--C	0.077132	0.006635	11.62503	0.0000
URU--C	0.023486	0.012168	1.930134	0.0537
USA--C	0.106040	0.007463	14.20893	0.0000
VENE--C	0.022369	0.008922	2.507279	0.0122
ZAM--C	-0.083539	0.051980	-1.607147	0.1081
ZIM--C	-0.063372	0.016791	-3.774126	0.0002

Weighted Statistics

R-squared	0.150948	Mean dependent var	0.007338
Adjusted R-squared	0.115139	S.D. dependent var	0.078062
S.E. of regression	0.073431	Sum squared resid	14.57475
F-statistic	4.215357	Durbin-Watson stat	1.879326
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.119936	Mean dependent var	0.004490
Adjusted R-squared	0.082819	S.D. dependent var	0.076674
S.E. of regression	0.073431	Sum squared resid	14.57476
Durbin-Watson stat	1.983928		

2. Regression results from estimating equation (4.1) using the data in the 1980-2000 sample

Dependent Variable: D(Y?)
Method: GLS (Cross Section Weights)
Date: 03/05/05 Time: 14:46
Included observations: 20
Number of cross-sections used: 114
Total panel (unbalanced) observations: 2240
Convergence achieved after 5 iteration(s)
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y?(-1)	-0.061884	0.004992	-12.39692	0.0000
ALG--C	-0.044307	0.018710	-2.368069	0.0180
ANG--C	-0.134746	0.068286	-1.973265	0.0486
ARG--C	-0.002072	0.016123	-0.128509	0.8978
AUS--C	0.062902	0.005318	11.82754	0.0000
AUT--C	0.059133	0.005020	11.77966	0.0000
BAN--C	-0.100261	0.009011	-11.12699	0.0000
BARB--C	0.029625	0.009801	3.022628	0.0025
BEL--C	0.057860	0.004901	11.80555	0.0000

→ $\hat{\beta}_1 = 0.061884$

BEN--C	-0.137798	0.011501	-11.98124	0.0000
BOL--C	-0.090377	0.005308	-17.02692	0.0000
BOTS--C	-0.006493	0.007532	-0.862099	0.3887
BRA--C	-0.020860	0.002875	-7.256320	0.0000
BURK--C	-0.141161	0.014544	-9.705692	0.0000
BURU--C	-0.176029	0.031298	-5.624286	0.0000
CAM--C	-0.091789	0.031982	-2.869974	0.0041
CAN--C	0.064611	0.005772	11.19427	0.0000
CAPE--C	-0.045205	0.005676	-7.963956	0.0000
CAR--C	-0.153776	0.027503	-5.591233	0.0000
CDR--C	-0.230040	0.042794	-5.375499	0.0000
CHAD--C	-0.170606	0.048192	-3.540175	0.0004
CHI--C	0.001195	0.009824	0.121600	0.9032
CHN--C	-0.042170	0.008407	-5.016263	0.0000
COL--C	-0.034364	0.003199	-10.74276	0.0000
COM--C	-0.108743	0.020597	-5.279546	0.0000
CON--C	-0.091471	0.108367	-0.844085	0.3987
COTE--C	-0.111214	0.009493	-11.71509	0.0000
CR--C	-0.041786	0.007960	-5.249794	0.0000
CYP--C	0.059290	0.005098	11.62969	0.0000
DEN--C	0.067262	0.005572	12.07055	0.0000
DOM--C	-0.043324	0.011968	-3.619959	0.0003
ECUA--C	-0.073776	0.006137	-12.02141	0.0000
EGY--C	-0.051801	0.005850	-8.854831	0.0000
EQU--C	-0.031229	0.225892	-0.138247	0.8901
ES--C	-0.060053	0.007398	-8.117204	0.0000
ETHI--C	-0.175500	0.021277	-8.248271	0.0000
FIJI--C	-0.033556	0.008920	-3.761825	0.0002
FIN--C	0.057852	0.005702	10.14608	0.0000
FRA--C	0.054959	0.004920	11.16963	0.0000
GAB--C	-0.038534	0.037178	-1.036485	0.3001
GAM--C	-0.148617	0.011447	-12.98307	0.0000
GER--C	0.057127	0.004981	11.46973	0.0000
GHA--C	-0.137196	0.010838	-12.65885	0.0000
GRE--C	0.022798	0.002645	8.619439	0.0000
GUAT--C	-0.062165	0.003563	-17.44673	0.0000
GUIN--C	-0.154600	0.065252	-2.369271	0.0179
GUY--C	-0.072811	0.037811	-1.925649	0.0543
HAI--C	-0.093886	0.037760	-2.486410	0.0130
HK--C	0.079876	0.007073	11.29280	0.0000
HON--C	-0.102289	0.006937	-14.74473	0.0000
ICE--C	0.061286	0.006671	9.187543	0.0000
INDI--C	-0.074445	0.007433	-10.01485	0.0000
INDO--C	-0.044925	0.008918	-5.037543	0.0000
IRAN--C	-0.030487	0.018797	-1.621909	0.1050
IRE--C	0.068993	0.003901	17.68716	0.0000
ISR--C	0.043562	0.003662	11.89506	0.0000
ITA--C	0.055649	0.004982	11.17092	0.0000
JAM--C	-0.064444	0.018145	-3.551536	0.0004
JAP--C	0.067087	0.005555	12.07700	0.0000
JOR--C	-0.052961	0.011045	-4.794872	0.0000
KEN--C	-0.130841	0.010070	-12.99258	0.0000
KORE--C	0.050289	0.006048	8.315692	0.0000
LESO--C	-0.123394	0.010864	-11.35851	0.0000
LUX--C	0.106599	0.008605	12.38864	0.0000
MAD--C	-0.167272	0.010717	-15.60864	0.0000

→ $\hat{c}_1(\text{chn}) = -0.042170$

MAIL--C	-0.154494	0.013810	-11.18698	0.0000
MAL--C	-0.163498	0.045117	-3.623857	0.0003
MALA--C	0.000564	0.013869	0.040701	0.9675
MAU--C	-0.132069	0.012885	-10.25007	0.0000
MAUR--C	0.034817	0.006224	5.593945	0.0000
MEX--C	-0.010434	0.006988	-1.492993	0.1356
MOR--C	-0.052251	0.013238	-3.947041	0.0001
MOZA--C	-0.158110	0.014423	-10.96270	0.0000
NAMI--C	-0.054347	0.007447	-7.297649	0.0000
NEP--C	-0.110685	0.009605	-11.52312	0.0000
NETH--C	0.059588	0.004879	12.21228	0.0000
NICA--C	-0.123214	0.039432	-3.124694	0.0018
NIG--C	-0.163554	0.016102	-10.15739	0.0000
NIGE--C	-0.178277	0.031143	-5.724478	0.0000
NOR--C	0.071553	0.006169	11.59965	0.0000
NZ--C	0.044576	0.004781	9.323940	0.0000
PAK--C	-0.090611	0.007707	-11.75657	0.0000
PANA--C	-0.027003	0.009919	-2.722452	0.0065
PARA--C	-0.045760	0.012062	-3.793726	0.0002
PERU--C	-0.057812	0.016247	-3.558440	0.0004
PHI--C	-0.065540	0.005548	-11.81242	0.0000
PNG--C	-0.073865	0.020567	-3.591412	0.0003
PORT--C	0.038548	0.003633	10.61112	0.0000
PUE--C	0.027110	0.003135	8.647063	0.0000
ROM--C	-0.043734	0.010684	-4.093524	0.0000
RWAN--C	-0.150643	0.099999	-1.506440	0.1321
SA--C	-0.022898	0.001387	-16.50656	0.0000
SENE--C	-0.114802	0.009463	-12.13124	0.0000
SEY--C	0.009339	0.026956	0.346455	0.7290
SIER--C	-0.150149	0.017697	-8.484616	0.0000
SING--C	0.080311	0.006268	12.81308	0.0000
SPA--C	0.042092	0.004294	9.802032	0.0000
SRI--C	-0.048010	0.008549	-5.615506	0.0000
SWE--C	0.056121	0.005292	10.60440	0.0000
SWI--C	0.065016	0.006096	10.66570	0.0000
SYR--C	-0.061673	0.010485	-5.882251	0.0000
TAIW--C	0.065888	0.002434	27.07013	0.0000
TAN--C	-0.200782	0.035037	-5.730564	0.0000
THAI--C	-0.009711	0.008848	-1.097579	0.2725
TOGO--C	-0.157780	0.021936	-7.192585	0.0000
TRIN--C	0.003483	0.032735	0.106389	0.9153
TUNI--C	-0.023110	0.003006	-7.686581	0.0000
TURK--C	-0.013216	0.006573	-2.010467	0.0445
UGA--C	-0.125137	0.025287	-4.948593	0.0000
UK--C	0.057795	0.004567	12.65552	0.0000
URU--C	-0.004144	0.011865	-0.349244	0.7269
USA--C	0.080998	0.006444	12.57035	0.0000
VENE--C	-0.032008	0.006898	-4.640419	0.0000
ZAM--C	-0.172818	0.022412	-7.711069	0.0000
ZIM--C	-0.083459	0.012292	-6.789449	0.0000

Weighted Statistics

R-squared	0.239418	Mean dependent var	-0.011176
Adjusted R-squared	0.198615	S.D. dependent var	0.074188

S.E. of regression	0.066413	Sum squared resid	9.372843
F-statistic	5.867652	Durbin-Watson stat	1.689338
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.134854	Mean dependent var	-0.010889
Adjusted R-squared	0.088442	S.D. dependent var	0.069561
S.E. of regression	0.066413	Sum squared resid	9.372843
Durbin-Watson stat	1.747767		

3. Regression results from estimating equation (4.2) using the data in the 1950-2000 sample

Dependent Variable: D(Y?)
Method: GLS (Cross Section Weights)
Date: 03/03/05 Time: 14:14
Included observations: 50
Number of cross-sections used: 114
Total panel (unbalanced) observations: 5172
Convergence achieved after 5 iteration(s)
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y?(-1)	-0.080113	0.004383	-18.27622	0.0000
DUMMY*Y?(-1)	0.016589	0.009470	1.751723	0.0799
ALG--C	-0.019521	0.039109	-0.499150	0.6177
ANG--C	-0.077512	0.044930	-1.725170	0.0846
ARG--C	0.047896	0.011848	4.042425	0.0001
AUS--C	0.085341	0.006506	13.11701	0.0000
AUT--C	0.081590	0.006462	12.62563	0.0000
BAN--C	-0.144058	0.017682	-8.147298	0.0000
BARB--C	0.064992	0.012226	5.315646	0.0000
BEL--C	0.079779	0.005420	14.71996	0.0000
BEN--C	-0.128577	0.013902	-9.248870	0.0000
BOL--C	-0.051841	0.011273	-4.598661	0.0000
BOTS--C	-0.060224	0.017276	-3.485924	0.0005
BRA--C	-0.002601	0.005158	-0.504213	0.6141
BURK--C	-0.165257	0.019329	-8.549747	0.0000
BURU--C	-0.152763	0.031179	-4.899607	0.0000
CAM--C	-0.096548	0.019116	-5.050654	0.0000
CAN--C	0.092185	0.005716	16.12832	0.0000
CAPE--C	-0.117099	0.022903	-5.112859	0.0000
CAR--C	-0.102291	0.024483	-4.178068	0.0000
CDR--C	-0.136412	0.023659	-5.765837	0.0000
CHAD--C	-0.118671	0.032103	-3.696577	0.0002
CHI--C	-0.000411	0.014730	-0.027870	0.9778
CHN--C	-0.138126	0.010814	-12.77258	0.0000
COL--C	-0.028099	0.004115	-6.827861	0.0000
COM--C	-0.073548	0.021882	-3.361049	0.0008
CON--C	-0.100718	0.078562	-1.282013	0.1999
COTE--C	-0.040644	0.014097	-2.883214	0.0040
CR--C	0.000948	0.008401	0.112859	0.9101
CYP--C	0.015449	0.017624	0.876567	0.3808
DEN--C	0.095010	0.007214	13.17074	0.0000
DOM--C	-0.055017	0.016019	-3.434592	0.0006

→
$C(1) = -0.080113$
$C(2) = 0.016589$
$\hat{\beta}_0 = -C(1) = 0.080113$
$\hat{\lambda} = C(2) = 0.016589$
$\hat{\beta}_1 = \hat{\beta}_0 - \hat{\lambda} = 0.063524$

→
$C(24) = -0.138126$
$\hat{c}_0(chn) = C(24) = -0.138126$

ECUA--C	-0.029805	0.009102	-3.274677	0.0011
EGY--C	-0.068773	0.008247	-8.339639	0.0000
EQU--C	-0.076719	0.083707	-0.916518	0.3594
ES--C	-0.011172	0.007444	-1.500849	0.1335
ETHI--C	-0.164370	0.012680	-12.96287	0.0000
FIJI--C	-0.030446	0.015323	-1.986923	0.0470
FIN--C	0.077116	0.008197	9.407378	0.0000
FRA--C	0.082981	0.005081	16.33157	0.0000
GAB--C	0.067063	0.032315	2.075271	0.0380
GAM--C	-0.105250	0.015334	-6.863789	0.0000
GER--C	0.074063	0.004223	17.53860	0.0000
GHA--C	-0.104700	0.012161	-8.609223	0.0000
GRE--C	0.053835	0.004595	11.71657	0.0000
GUAT--C	-0.031255	0.003814	-8.194859	0.0000
GUIN--C	-0.165835	0.034318	-4.832245	0.0000
GUY--C	-0.047501	0.038611	-1.230238	0.2187
HAI--C	-0.153948	0.013098	-11.75326	0.0000
HK--C	0.061592	0.006839	9.005673	0.0000
HON--C	-0.074985	0.007314	-10.25157	0.0000
ICE--C	0.083948	0.008881	9.452940	0.0000
INDI--C	-0.123863	0.009665	-12.81516	0.0000
INDO--C	-0.120892	0.013730	-8.804790	0.0000
IRAN--C	0.008397	0.025333	0.331441	0.7403
IRE--C	0.040778	0.006402	6.369672	0.0000
ISR--C	0.050028	0.010250	4.881009	0.0000
ITA--C	0.076121	0.004925	15.45593	0.0000
JAM--C	-0.029306	0.015111	-1.939379	0.0525
JAP--C	0.079827	0.006593	12.10725	0.0000
JOR--C	-0.046080	0.036648	-1.257355	0.2087
KEN--C	-0.120414	0.013669	-8.808978	0.0000
KORE--C	-0.026583	0.007978	-3.331975	0.0009
LESO--C	-0.112103	0.017044	-6.577262	0.0000
LUX--C	0.099175	0.017927	5.532038	0.0000
MAD--C	-0.133188	0.006949	-19.16527	0.0000
MAIL--C	-0.166456	0.019601	-8.492450	0.0000
MAL--C	-0.165261	0.017563	-9.409802	0.0000
MALA--C	-0.027848	0.015125	-1.841219	0.0656
MAU--C	-0.086956	0.039856	-2.181785	0.0292
MAUR--C	-0.003834	0.018852	-0.203354	0.8389
MEX--C	0.019279	0.005632	3.423430	0.0006
MOR--C	-0.057463	0.010180	-5.644851	0.0000
MOZA--C	-0.097300	0.014835	-6.558928	0.0000
NAMI--C	0.016233	0.006296	2.578304	0.0100
NEP--C	-0.158363	0.008361	-18.94004	0.0000
NETH--C	0.086509	0.006388	13.54177	0.0000
NICA--C	-0.016093	0.020348	-0.790863	0.4291
NIG--C	-0.142922	0.029224	-4.890519	0.0000
NIGE--C	-0.122764	0.035027	-3.504879	0.0005
NOR--C	0.086238	0.005530	15.59331	0.0000
NZ--C	0.076831	0.011400	6.739499	0.0000
PAK--C	-0.124414	0.008945	-13.90929	0.0000
PANA--C	-0.019739	0.006683	-2.953827	0.0032
PARA--C	-0.046016	0.007241	-6.354734	0.0000
PERU--C	-0.001215	0.008765	-0.138572	0.8898
PHI--C	-0.044501	0.005815	-7.653124	0.0000
PNG--C	-0.027751	0.012024	-2.308008	0.0210

	PORT--C	0.029653	0.005394	5.497585	0.0000
90	PUE--C	0.038657	0.007902	4.892250	0.0000
	ROM--C	-0.018048	0.007741	-2.331366	0.0198
	RWAN--C	-0.162047	0.029152	-5.558610	0.0000
	SA--C	0.024394	0.004357	5.599021	0.0000
	SENE--C	-0.118078	0.010300	-11.46333	0.0000
95	SEY--C	-0.010988	0.021492	-0.511236	0.6092
	SIER--C	-0.122955	0.016172	-7.602922	0.0000
	SING--C	0.052803	0.033207	1.590102	0.1119
	SPA--C	0.060376	0.006992	8.635109	0.0000
	SRI--C	-0.094296	0.012595	-7.486930	0.0000
100	SWE--C	0.092061	0.006395	14.39634	0.0000
	SWI--C	0.108774	0.008153	13.34116	0.0000
	SYR--C	-0.029160	0.036239	-0.804654	0.4211
	TAIW--C	-0.014203	0.007665	-1.852921	0.0640
	TAN--C	-0.169503	0.014785	-11.46432	0.0000
105	THAI--C	-0.070896	0.011432	-6.201539	0.0000
	TOGO--C	-0.120022	0.122033	-0.983519	0.3254
	TRIN--C	0.044953	0.017298	2.598710	0.0094
	TUNI--C	-0.034150	0.006681	-5.111783	0.0000
	TURK--C	-0.011047	0.009083	-1.216286	0.2239
110	UGA--C	-0.182499	0.019054	-9.578136	0.0000
	UK--C	0.076818	0.005734	13.39705	0.0000
	URU--C	0.023366	0.011851	1.971659	0.0487
	USA--C	0.105602	0.006586	16.03474	0.0000
	VENE--C	0.022324	0.008532	2.616345	0.0089
115	ZAM--C	-0.083318	0.044290	-1.881192	0.0600
	ZIM--C	-0.063120	0.015557	-4.057347	0.0001
	ALG--DUMMY	-0.017636	0.046471	-0.379519	0.7043
	ANG--DUMMY	-0.047756	0.074876	-0.637800	0.5236
	ARG--DUMMY	-0.047154	0.018529	-2.544862	0.0110
120	AUS--DUMMY	-0.021150	0.011034	-1.916768	0.0553
	AUT--DUMMY	-0.021298	0.010654	-1.999111	0.0457
	BAN--DUMMY	0.036909	0.023762	1.553295	0.1204
	BARB--DUMMY	-0.028542	0.017126	-1.666567	0.0957
	BEL--DUMMY	-0.020075	0.009870	-2.033991	0.0420
125	BEN--DUMMY	-0.010092	0.022481	-0.448900	0.6535
	BOL--DUMMY	-0.038512	0.014566	-2.643993	0.0082
	BOTS--DUMMY	0.054617	0.019788	2.760098	0.0058
	BRA--DUMMY	-0.016046	0.006453	-2.486646	0.0129
	BURK--DUMMY	0.020219	0.028481	0.709891	0.4778
130	BURU--DUMMY	-0.031376	0.045068	-0.696184	0.4863
	CAM--DUMMY	0.001301	0.032654	0.039857	0.9682
	CAN--DUMMY	-0.025508	0.011108	-2.296409	0.0217
	CAPE--DUMMY	0.083352	0.028399	2.935065	0.0034
	CAR--DUMMY	-0.054687	0.035956	-1.520949	0.1283
135	CDR--DUMMY	-0.095207	0.044543	-2.137416	0.0326
	CHAD--DUMMY	-0.054037	0.051942	-1.040322	0.2982
	CHI--DUMMY	0.001688	0.018537	0.091051	0.9275
	CHN--DUMMY	0.091538	0.016694	5.483460	0.0000
	COL--DUMMY	-0.006496	0.006021	-1.078935	0.2807
140	COM--DUMMY	-0.039598	0.030408	-1.302228	0.1929
	CON--DUMMY	0.016592	0.121160	0.136943	0.8911
	COTE--DUMMY	-0.083474	0.023012	-3.627450	0.0003
	CR--DUMMY	-0.043866	0.011812	-3.713606	0.0002
	CYP--DUMMY	0.043526	0.019977	2.178807	0.0294

$C(138) = 0.091538$

$\hat{\gamma}(\text{chn}) = C(138) = 0.091538$

$\hat{c}_1(\text{chn}) = \hat{c}_0(\text{chn}) + \hat{\gamma}(\text{chn})$

$= C(24) + C(138)$

$= -0.046588$

145	DEN--DUMMY	-0.027937	0.011911	-2.345545	0.0190
	DOM--DUMMY	0.016263	0.022111	0.735529	0.4621
	ECUA--DUMMY	-0.041196	0.012554	-3.281544	0.0010
	EGY--DUMMY	0.021359	0.012524	1.705371	0.0882
	EQU--DUMMY	0.035498	0.181878	0.195173	0.8453
150	ES--DUMMY	-0.055192	0.012303	-4.486213	0.0000
	ETHI--DUMMY	-0.013714	0.028141	-0.487324	0.6261
	FIJI--DUMMY	-0.005654	0.018518	-0.305356	0.7601
	FIN--DUMMY	-0.017483	0.012170	-1.436565	0.1509
	FRA--DUMMY	-0.027203	0.009693	-2.806370	0.0050
155	GAB--DUMMY	-0.093693	0.049410	-1.896253	0.0580
	GAM--DUMMY	-0.039730	0.023766	-1.671668	0.0947
	GER--DUMMY	-0.016616	0.009156	-1.814749	0.0696
	GHA--DUMMY	-0.033168	0.020437	-1.622951	0.1047
	GRE--DUMMY	-0.030680	0.006498	-4.721836	0.0000
160	GUAT--DUMMY	-0.030182	0.006996	-4.314263	0.0000
	GUIN--DUMMY	0.000630	0.063311	0.009958	0.9921
	GUY--DUMMY	-0.024276	0.054447	-0.445865	0.6557
	HAI--DUMMY	0.059541	0.032303	1.843215	0.0654
	HK--DUMMY	0.020873	0.011777	1.772377	0.0764
165	HON--DUMMY	-0.028234	0.013143	-2.148249	0.0317
	ICE--DUMMY	-0.019736	0.013651	-1.445778	0.1483
	INDI--DUMMY	0.047040	0.015952	2.948793	0.0032
	INDO--DUMMY	0.078650	0.018084	4.349114	0.0000
	IRAN--DUMMY	-0.047429	0.034046	-1.393111	0.1636
170	IRE--DUMMY	0.026554	0.009222	2.879341	0.0040
	ISR--DUMMY	-0.004295	0.012175	-0.352730	0.7243
	ITA--DUMMY	-0.019086	0.009485	-2.012205	0.0443
	JAM--DUMMY	-0.040148	0.023197	-1.730751	0.0836
	JAP--DUMMY	-0.012065	0.011368	-1.061303	0.2886
175	JOR--DUMMY	-0.004368	0.041098	-0.106274	0.9154
	KEN--DUMMY	-0.015140	0.021444	-0.706002	0.4802
	KORE--DUMMY	0.069771	0.011900	5.863030	0.0000
	LESO--DUMMY	-0.012883	0.023302	-0.552866	0.5804
	LUX--DUMMY	0.007076	0.022901	0.308963	0.7574
180	MAD--DUMMY	-0.035658	0.018765	-1.900304	0.0575
	MAIL--DUMMY	0.006888	0.028521	0.241511	0.8092
	MAL--DUMMY	-0.001888	0.038810	-0.048636	0.9612
	MALA--DUMMY	0.029593	0.020254	1.461102	0.1441
	MAU--DUMMY	-0.049506	0.045000	-1.100133	0.2713
185	MAUR--DUMMY	0.032219	0.022648	1.422567	0.1549
	MEX--DUMMY	-0.025751	0.008876	-2.901247	0.0037
	MOR--DUMMY	0.003412	0.016311	0.209216	0.8343
	MOZA--DUMMY	-0.068912	0.025023	-2.753980	0.0059
	NAMI--DUMMY	-0.081965	0.013399	-6.117065	0.0000
190	NEP--DUMMY	0.039335	0.018188	2.162700	0.0306
	NETH--DUMMY	-0.026329	0.010471	-2.514361	0.0120
	NICA--DUMMY	-0.106364	0.038194	-2.784838	0.0054
	NIG--DUMMY	-0.022761	0.037326	-0.609792	0.5420
	NIGE--DUMMY	-0.045909	0.054402	-0.843879	0.3988
195	NOR--DUMMY	-0.010289	0.011282	-0.912022	0.3618
	NZ--DUMMY	-0.032115	0.014084	-2.280196	0.0226
	PAK--DUMMY	0.032477	0.015647	2.075528	0.0380
	PANA--DUMMY	-0.002176	0.011797	-0.184503	0.8536
	PARA--DUMMY	0.006658	0.013962	0.476860	0.6335
200	PERU--DUMMY	-0.056910	0.015854	-3.589599	0.0003

PHI--DUMMY	-0.021617	0.010065	-2.147626	0.0318
PNG--DUMMY	-0.050823	0.020912	-2.430301	0.0151
PORT--DUMMY	0.008462	0.007487	1.130294	0.2584
PUE--DUMMY	-0.013484	0.010030	-1.344286	0.1789
ROM--DUMMY	-0.025535	0.011862	-2.152582	0.0314
RWAN--DUMMY	0.006931	0.074017	0.093634	0.9254
SA--DUMMY	-0.043194	0.005359	-8.060157	0.0000
SENE--DUMMY	-0.002051	0.017701	-0.115876	0.9078
SEY--DUMMY	0.020589	0.031005	0.664063	0.5067
SIER--DUMMY	-0.024400	0.026484	-0.921282	0.3569
SING--DUMMY	0.029110	0.035241	0.826042	0.4088
SPA--DUMMY	-0.018932	0.009726	-1.946413	0.0517
SRI--DUMMY	0.040305	0.017849	2.258113	0.0240
SWE--DUMMY	-0.034214	0.010885	-3.143329	0.0017
SWI--DUMMY	-0.041155	0.013114	-3.138200	0.0017
SYR--DUMMY	-0.030775	0.039739	-0.774442	0.4387
TAIW--DUMMY	0.076756	0.009138	8.399376	0.0000
TAN--DUMMY	-0.037240	0.035734	-1.042128	0.2974
THAI--DUMMY	0.058313	0.015410	3.784105	0.0002
TOGO--DUMMY	-0.031513	0.130777	-0.240968	0.8096
TRIN--DUMMY	-0.035963	0.031639	-1.136676	0.2557
TUNI--DUMMY	0.012156	0.007956	1.527847	0.1266
TURK--DUMMY	-0.005246	0.012010	-0.436771	0.6623
UGA--DUMMY	0.049904	0.033122	1.506656	0.1320
UK--DUMMY	-0.019219	0.009654	-1.990671	0.0466
URU--DUMMY	-0.025540	0.016626	-1.536165	0.1246
USA--DUMMY	-0.024273	0.012711	-1.909659	0.0562
VENE--DUMMY	-0.050704	0.011646	-4.353740	0.0000
ZAM--DUMMY	-0.091565	0.053881	-1.699387	0.0893
ZIM--DUMMY	-0.019718	0.021332	-0.924343	0.3554

Weighted Statistics

R-squared	0.173353	Mean dependent var	-0.000193
Adjusted R-squared	0.135048	S.D. dependent var	0.076152
S.E. of regression	0.070823	Sum squared resid	24.78871
F-statistic	4.525623	Durbin-Watson stat	1.812919
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.132752	Mean dependent var	-0.002447
Adjusted R-squared	0.092566	S.D. dependent var	0.074348
S.E. of regression	0.070823	Sum squared resid	24.78871
Durbin-Watson stat	1.882558		

4. Results of the Wald test of $H_0: \beta_1 = 0$ (where: β_1 is the speed of convergence in the 1980-2000 period.)

Wald Test:
Equation: DCD

Null Hypothesis:	-C(1) - C(2) = 0		
F-statistic	57.26415	Probability	0.000000
Chi-square	57.26415	Probability	0.000000

Note: the coefficient -C(1) denotes $\hat{\beta}_0$ and the coefficient C(2) denotes $\hat{\lambda}$, both are obtained from estimating equation (4.2).

5. Results of the Wald test for H_0: c_1 (chn) = 0 (where: c_1 (chn) is the constant term of China in the 1980-2000 period.)

Wald Test:
Equation: DCD

Null Hypothesis:	C(24) + C(138) = 0		
F-statistic	13.42046	Probability	0.000252
Chi-square	13.42046	Probability	0.000249

Note: the coefficient C(24) denotes $\hat{c}_0$ (chn) and the coefficient C(138) denotes $\hat{\gamma}$ (chn), both are obtained from estimating equation (4.2).

6. Results of the Wald test for H_0: y_0^* (chn) = 0 (where: y_0^* (chn) is China's relative steady state in the 1950-1979 period.)

Wald Test:
Equation: DCD

Null Hypothesis:	C(24)/(-C(1)) = 0		
F-statistic	335.3730	Probability	0.000000
Chi-square	335.3730	Probability	0.000000

Note: the coefficient C(24)/(-C(1)) denotes $\hat{c}_0$ (chn)/ $\hat{\beta}_0$ (= $\hat{y}_0^*$ (chn)), which is obtained from estimating equation (4.2).

7. Results of the Wald test for H_0: y_1^* (chn) = 0 (where: y_1^* (chn) is China's relative steady state in the 1980-2000 period)

Wald Test:
Equation: DCD

Null Hypothesis:	(C(24) + C(138))/(-C(1) - C(2)) = 0		
F-statistic	34.73508	Probability	0.000000
Chi-square	34.73508	Probability	0.000000

Note: the coefficient (C(24) + C(138))/(-C(1) - C(2)) denotes $\hat{c}_1$ (chn)/ $\hat{\beta}_1$ (= $\hat{y}_1^*$ (chn)), which is obtained from estimating equation (4.2).

8. Results of the Wald test for H_0: y_1^* (chn) - y_0^* (chn) = 0 (where: y_0^* (chn) and y_1^* (chn) are the same as the previous.)

Wald Test:
Equation: DCD

Null Hypothesis:	(C(24)+C(138))/(-C(1)-C(2)) - C(24)/(-C(1)) =0		
F-statistic	40.31427	Probability	0.000000
Chi-square	40.31427	Probability	0.000000

Note: the coefficient (C(24) + C(138))/(-C(1) - C(2)) denotes $\hat{c}_1$ (chn)/ $\hat{\beta}_1$ (= $\hat{y}_1^*$ (chn)) and the coefficient C(24)/(-C(1)) denotes $\hat{c}_0$ (chn)/ $\hat{\beta}_0$ (= $\hat{y}_0^*$ (chn)). Both are obtained from estimating equation (4.2).