1-1-2004

Provincial Growth Convergence In China

Zhifang Peng
Eastern Illinois University

PROVINCIAL GROWTH CONVERGENCE IN CHINA

(TITLE)

BY

Zhifang Peng

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Arts in Economics

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2004

YEAR

I HEREBY RECOMMEND THAT THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

6 January 2005
DATE

Lawrence W. Botts
THESIS DIRECTOR

January 6, 2005
DATE

Chichin Kabirzoon
DEPARTMENT/SCHOOL HEAD

THESIS REPRODUCTION CERTIFICATE

TO: Graduate Degree Candidates (who have written formal theses)

SUBJECT: Permission to Reproduce Theses

The University Library is receiving a number of request from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow these to be copied.

PLEASE SIGN ONE OF THE FOLLOWING STATEMENTS:

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

Author's Signature

01/07/2002

Date

I respectfully request Booth Library of Eastern Illinois University **NOT** allow my thesis to be reproduced because:

_____

_____

_____

_____ _____

Author's Signature Date

Thesis Committee

Lawrence W. Bates

Lawrence Bates, Ph.D.
Professor
Thesis Director
Department of Economics

6 January 2005
Date

Chechin Karbassioun
for Mukti Upadhyay, Ph.D.
Professor
Department of Economics

January 6, 2005
Date

Minh Q. Dao
Minh Q. Dao, Ph.D.
Professor
Department of Economics

January 6, 2005
Date

僅以此文獻給我摯愛的父母！

Acknowledgements

I'd like to express my appreciation and thanks to my advisor, Dr. Lawrence Bates, for his guidance, wisdom, encouragement, and patience throughout the process of this research and during my study at EIU. I could not have finished my thesis without his fully understanding.

Special thanks are due to other graduate advisory committee members, Dr. Mukti Upadhyay, and Dr. Minh Q. Dao, for their helpful suggestions and comments. Thanks go to Dr. Hui Li and other faculty members at the Department of Economics for additional suggestion, also to Lois, the secretary of the Department of Economics, for helping me with administrative tasks.

I wish to thank the leader of Kunming University of Science and Technology and the law school in KUST who allowed me to leave the job temporarily during my study. Thanks also due to the Chair of the Department of Economics, Dr. Karbassioon and the Graduate Coordinator, Dr. Hake, for giving me teaching assistantship; Dr. Upadhyay, for giving me a research assistant job in summer 2003; the Economics Graduate Faculty Committee and the Graduate School in Eastern Illinois University, who gave me Distinguished Graduate Student Award.

Finally, a great appreciation and thanks goes to my lovely husband Kai, my kindly parents ZhenQing Yang and Baochun Peng and my sweetest daughter Janice, for loving me, encouraging me and caring of me during the many chaotic days toward my completion.

Abstract

This thesis deals with the convergence in China, which focuses on β-convergence analysis during post-reformation period, and identifies some of the major factors that influence convergence.

It suggest that both σ and β convergence exist during the first period of reformation, while don't exist in later period; factors for conditional convergence are different from period to period. These may attributable to the gradual development of government policy. It concludes that while absolute β-convergence model is more appropriate to the countries with settled economic and social structure such as U.S. and Europe, when government play a large role in transition such as in China, a conditional β-convergence is more appropriate.

Table of Contents

Chapter 1

Introduction

Poverty and the alleviation of poverty is one of the paramount topics facing our world. The United Nations Economics and Social Council focuses primarily on poverty and economic development so that among the ten United Nations Programmes six of them are focused on poverty or economic development. Poverty and development are also important considerations for nations and governments. The People's Republic of China, for example, is a large developing country with 31 provinces, auto-authority regions, and municipalities. Influenced by socialist ideology and egalitarian ideas, the government established a policy which seeks to achieve relative economic equality. Thus regional inequality has been one of the major concerns to the Chinese government since the establishment of the People's Republic of China in 1949. Although China puts forward "getting rich together" as the goal of economic development(Deng, 1985), several scholars have provided overwhelming evidence to support the persistence or widening of regional inequality relative to the period before reformation. (Cannon, 1990) (Wei, 1996) (Zhou, 1996)

Although China is experiencing very rapid economic growth, regional economic inequality continues to be a controversial topic in China. An economic theory concerning convergence and the debate surrounding the theory relates to

China's concern about economic disparity among the provinces. In growth theory, convergence is a theory that economic regions that are developing slowly or not growing at all and regions that are growing more rapidly will converge to a single steady state of economic growth adjusted for differences in population growth, technological change, and human capital. The literature identifies two types of convergence, sigma convergence and beta convergence. Sigma convergence occurs when the dispersion of per capita incomes of different countries or different provinces falls over time. Beta convergence occurs when there is an inverse relationship between the growth of income and its initial level, countries with higher levels of income tend to grow more slowly and those with lower levels of income tend to grow more rapidly.

This thesis focuses on economic convergence in the People's Republic of China. It hypothesizes that convergence is not absolute but conditional in the period under consideration and will identify some of the major factors that influence convergence. Thus the topic of the thesis has both theoretical and practical importance to the world.

The Theory of Convergence

The theory of convergence stems from the theory of economic growth which in its modern form began with the writings of Roy Harrod (1934) and Evsey Domar (1957). From equation (6) in Harrod's model comes the basic equation of neoclassical growth theory (Jones, 1976) where y=f(k).

$$\dot{k} = sy - nk \qquad (1)$$

This equation says that the rate of change of the capital labor ratio $\dot{k}$ is equal to the fraction of the output per worker that is saved minus the fraction of capital needed for new labor. If we eliminate the assumption of no depreciation in the system, some of the saving must be used for replacing worn out capital. Since d percent of k is worn out, the equation becomes

$$\dot{k} = sy - (n+d)k \qquad (2)$$

This equation says that the rate of change of the capital to labor ratio is equal to the fraction of income per person saved minus the fraction of income per person that must be used for depreciation and for growth of labor. (Dornbusch, Fisher, and Startz, 2001). The economy is in a steady state or on a balanced growth path when the rate of change of the capital to labor ratio is equal to zero (K/L ratio is constant). This occurs when

$$sy = (n+d)k \qquad (3)$$

or the fraction of income per person saved is equal to the capital requirements for depreciation and for population growth. This balanced growth path is determined by n+d. Thus any increase in the saving rate s will bring about changes in income per person y and the capital to labor ratio k but the growth rate will return to (n+d). This neoclassical growth theory with diminishing returns as developed by Solow

> does not predict convergence; it predicts only that income per capita in a given country converges to that country's steady state value. In other words, the Solow model predicts convergence only after controlling for the determinants of the steady state, a phenomenon that might be called "conditional convergence" (Mankiw, 1992, p 422).

The structure of this study is as follows. The introduction including the definition of the problem this paper will tackle is discussed in Chapter 1. Chapter 2 is a review of the literature concerning the brief history of Chinese reformation and the variables which affect the economy convergence among Chinese provinces. The hypotheses of this study are also discussed in this chapter. Chapter 3 defines the variables, specifies the model and outlines the method of the current research, including the statistical model used to analyze provincial convergence in China. For each equation introduced, the dependent and independent variables are specified, their theoretical relationships are discussed, and the sources and reliability of the data are given. The analysis of the regression results and the effect of each variable are described in Chapter 4, including the evaluation the overall model, goodness of fit of the model to the data, statistic significance of each independent variable and interpretation of each regression coefficient estimate. The regression results are presented in tabular form. The final chapter includes a summary of the whole study, results and gives concluding remarks as well as suggestions for future research.

Chapter 2

Review of Literature

In this chapter, I will review the path to the economic reformation chosen by China. It will then provide a review of convergence studies and concerns relating to China and other nations in the world. Finally, this chapter will discuss the causes of convergence. It concludes with a statement of the hypotheses of this study.

2.1 Economic Reformation path of China

Twenty-five years of reform has brought impressive success and economic transformation to China. Since the start of reforms in 1978, GDP growth has averaged over 9 percent a year, raising real income per capita fivefold, and more than 200 million people have been lifted out of poverty. (Tseng, 2003)

China's reform strategy over this period can best be described as incremental. In the reform, the government established two tracks to development: a market track and a parallel preexisting track of a centrally planned economy. Then, the government gradually increased the importance of the market track over time.

This dual-track approach was initiated in late 1978 with the rapid and comprehensive liberalization of the agriculture sector.

2.1.1 Reformation in the Agriculture Sector

Since 1978, reforms in agriculture have taken place in roughly two stages. The first stage lasted from 1978 to 1983. This reform dismantled the highly collectivistic commune-brigade system and replaced it with household production. It gave the farms back to the farmers, generating huge increases in productivity, income, and output with negligible state investment. In this stage, agriculture procurement prices were increased[1], a "Responsibility System"[2] was developed, and the rural "free markets" were reestablished. However, the central government still maintained a monopoly in the marketing and distribution of most agricultural commodities.

The second stage began in 1984. The reform increased the role of collectives, households and market forces in the marketing and distribution of agricultural goods. The state monopoly on the purchase and distribution of agricultural goods was terminated. Rural households effectively faced market-determined prices in making their production decisions.

The initial market-oriented agricultural reforms also facilitated the liberalization of the industrial and services sectors in rural and urban areas. The regulations governing the registration and supervision of nonstate enterprises were progressively liberalized beginning in 1984, and the result was rapid industrialization, particularly by community-owned enterprises in rural areas, which came to be known as township and village enterprises (TVEs). Thus the dismantling of the communes and the emergence of the TVEs exposed nearly

800 million rural inhabitants (some 80% of the population at the time) to market forces and provided a large proportion of them the opportunity to leave agriculture over a relatively brief time span. (Tseng, 2003)

2.1.2 Reformation in the Industrial Sector

In contrast to the reform in agriculture, economic reform in the industrial sector has taken place more slowly and gradually.

Initial reform focused on re-adjusting various branches of industrial production, such as giving priority to light industry relative to heavy industry, the technological improvement and transformation of existing capital, and the expansion of consumer goods production. State owned enterprises (SOEs), which accounted for the majority of Chinese industry, was the target of attempts to introduce more market-based incentives to improve management and operational efficiency within the framework of state ownership during the first stage of the reformation. Beginning in 1984, decision-making power over production, marketing, and investment matters was incrementally shifted to SOE managers.

Only in January 1992, after Deng Xiaoping's celebrated tour of the South China, did the authorities formally embrace the view that the market system was not incompatible with socialism; this change set the stage for a deepening of reform in industry. The goal of the reform was to build a modern corporate system. The government tried to move small SOEs out of the state sector, place

large enterprises on commercial footing, shift the burden of lending away from state commercial banks, and reform some 1,000 large state firms that would be the pillars of China's industry.

Nonetheless, the 1990s saw growing evidence of the costs of the unreformed corporate and financial sectors. Despite greater autonomy and decentralization of management decisions, SOE performance has suffered from deeper problems rooted in the lack of tight budget constraints, weak management, and the requirement to provide job security and a range of social services. Growing competition, lower subsidies, and tighter credit (especially for smaller enterprises) revealed the poor performance of many SOEs in the 1990s, and prompted new approaches to reform.

Following the Fifteenth Party Congress in September 1997, industry reforms were expanded and accelerated. Some progress has been made in introducing modern management systems, shedding excess labor, and lowering the social welfare burden. However, many of the fundamental problems in establishing effective outside governance and financial discipline remain unresolved, especially in the larger SOEs.

2.1.3 Reformation in the Foreign Sector

Another purpose of the reformation was to integrate China into the global economy.

In May, 1980 four southern coastal cities – Shantou, Shenzhen, Xiamen, and Zhuhai—were designated as special economic zones (SEZs). They were provided certain discretionary powers over taxation and were given autonomy to experiment with new institutional forms, such as foreign-funded enterprises. In addition, SOEs operating in the SEZs were exempted from many elements of the central plan, such as certain labor regulations and the tax code. With the phenomenal initial growth of the SEZs, the privileges they were granted spread quickly to other areas[3] (Tseng, 2003).

During the new round of reform in 1990s, first, Pudong of Shanghai was opened. In 1991, four border cities on the China-Russia frontier were opened. In August, 1992, 15 more hinterland cities were opened, and since that time, major cities all over China have followed suit (Galbraith, 2000).

Besides geographic opening, institutions were changed to open China to foreign trade and foreign capital although at a slower pace than geographic opening.

With respect to trade, China has implemented a progressive decentralization of its foreign trading system, a system of export tax refunds, and it has applied the corporate system to foreign trading companies. Later, an export promotion policy was launched, including further decentralization, introducing the market system into foreign trade, and reform of the foreign exchange system. (Galbraith, 2000)

The Chinese currency became convertible for current account activities, non-tariff barriers were cut (reducing import quotas and shortening control list),

and tariffs reduced. Most recently, of course, China has negotiated its entry into the WTO, and further major reductions of tariffs and trade barriers are in prospect.

With respect to capital flows, in July 1979 China issued the joint venture law, which is the first regulatory document relating to foreign investment. In the same year, foreign investment was, for the first time, recorded in official statistics. The joint venture law encourages foreign investment in SEZ's and other coastal cities. In the first five years, foreign investment increased with an average annual growth rate of 34%, even though the amount of investment was very small. Later on, China improved its legal and regulatory system, and began to guide foreign capital to regions or industrial sectors preferred by the government (Galbraith, 2000). Beginning in 1992, after Deng Xiaoping's tour of southern provinces, foreign funds started pouring into China. Foreign investment in China grew from $6.7 billion in 1991, to $49.7 billion in 2001, with an average annual growth rate of 20%[4].

The most distinct feature of China's international trade and foreign investment is the considerable variations across the regions. Due to its proximity to Hong Kong, Guandong's trade performance has been the best, accounting for more than 40% of China's total trade from 1992 to 1994. Besides Guangdong, Shanghai, Fujian, Jiangsu and Liaoning make up the top five trading provinces in China. They overwhelmingly dominated China's trade, accounting for about 70% of China's total trade[5]. Guangdong has also for the past two decades been the largest recipient of foreign investment. And the ten coastal regions together have attracted the bulk of China's FDI.

In recent years, China has made continuous progress in its transforming to a market economy. Reforms over the past 10 years have completed the dismantling of the planned-economy apparatus (controlled prices and quantitative plans); fostered an increasing role for the private sector in the economy; opened the economy further to foreign trade and investment; enhanced the autonomy of state-owned banks and enterprise; and established the basic building blocks of a modern tax system and indirect monetary policy. (Tseng, 2003)

Although 25 years of reform have had a wide scope and diversified effects, it has a few major prominent characteristics of change and policy themes that have remained fundamental elements of the reform program since 1978.

The level of urbanization

Although the pace of urbanization has not been quite as dramatic as the absorption of agricultural labor by TVEs (town and village enterprises), some 80 million people have left the countryside to work in urban areas over the past two decades. China's level of urbanization (30.5% in 1998) is still well below the world average of 45%. Urbanization nevertheless has nearly doubled over the reform period, as controls on labor movements from rural to urban areas slowly have been relaxed. (Tseng, 2003)

The nonstate share of industrial output

One of the most noteworthy features of the reform process has been the rapid growth of nonstate economic entities[6]. The rising share of non-state output is also a good proxy for the increased marketization of the economy as well as

the rapid redeployment of labor from agriculture to industry. The nonstate sector's share of industrial output rose from just over 20% in 1978 to nearly 75% in 1999. (Tseng, 2003)

The share of total trade in output

Another notable feature of the reform period was that China became more integrated into the global economy: its share in world trade is now over 4 percent, compared with near zero in 1978. The share of total trade in GDP grew from less than 10% in the late 1970s to 41% in 1995[7], with an annual growth rate of over 8%. Such a rapid increase is very rare in a large country in only 16 years.

2.2 General Convergence Studies and Concerns

A large number of studies have been undertaken concerning the uneven development of China and other countries and areas. These studies represent a wide variety of opinions.

Kuznets (1955) first analyzed the common trend between the growth of national income and its distribution. He found that, as per capita income level went up, the inequality of personal income distribution became bigger until such a point where it began to narrow again.

By investigating the changing regional inequalities of income distribution in the US by economic zones and states during the 1840-1961 periods, Williamson (1965) concluded that regional inequality of income distribution followed the same inverted-U pattern, initially growing faster in more developed areas before

the less developed regions began to grow economically and inequalities diminished. He also argued that regional income distribution was positively related to the disparity of regional GDP level. Within a nation, the regional income disparity will also evolve along the inverted-U pattern as GDP levels change.

Solow (1956) defined β-convergence as faster growth of initially poor economies than their richer counterparts. He points out that such growth allows poor countries to catch up with rich countries.

Some economists (Sala-i-martin, 1996) (Quah, 1996) apply the concept of convergence to regional data sets, and provide evidence of β-convergence. Their results showed that there was no convergence among the large sample of economies, but it did exist within Organization of Economic Corporation Development (OECD) countries, and within single countries. Barro and Sala-i-Martin (1991,1992) examine data for the U.S. states over the period 1880-1990, for Japanese prefectures from 1930-1990, and for the regions of eight European countries from 1950-1990. They find that absolute β-convergence exists within these countries. Cashin and Sahay (1996) examine convergence within India and show the existence of absolute β-convergence.

Both Chinese and Western economists have carried out research to discover the trend of inequalities in income distribution and GDP level before and after the 1978 reform in China.

After studying the provincial disparities of net material product and national income; from 1952 to1985, Tsui (1991) argued that the provincial

inequalities were not narrowed between 1952 and 1978 in spite of a powerful fiscal income transfer mechanism.

China began her transition from a planned to a market economy towards the end of the 1970s. Since the early 1980s, many researchers have conducted empirical studies about China's post-reform economic performance (after 1978). Although China's gradual approach to economic reform has had considerable success, the social consequences of the reforms are still a topic of great controversy among researchers.

Some analysts have pointed out that the reform has incurred significant costs[8] (Lardy, 1998). They have generally applied a wide range of statistical indicators of regional inequality. Some research (Yang, 1999), (Barnard, 1997) show a rising income and wage inequality in China after its reformation.

2.3 The Factors of Convergence

Having presented a brief overview of the path of economic reformation in the People's Republic of China, and general convergence studies and concerns, this paper now turns to the discussion of the various factors which influence convergence as identified in the economic literature. These factors are: human capital, physical capital, urbanization level, industrialization speed, openness, agricultural share of total output, and the location[9].

The sources of economic growth can be classified into three categories: institutional innovation which improves resource efficiency, technological progress, and increase in inputs, (Fan, 1991; Wen, 1993)

Researchers have identified significant trends for these three categories. For example, some research (Escot, 2000), (Berthelemy, 1996), (Cho, 1994) shows that there is some relationship between convergence and international capital flows, financial development, and drastic industrialization. The World Bank (1995) divided China into seven regions and made comparisons of the distribution, of population, infant mortality rate, education and health care.

2.3.1 Government Development Strategy

In China's reform era, institutional innovations play a very important role. More and more researchers have come to conclude that the fundamental cause of regional disparities in China is the economic development strategy. Yang (1990), for example, labeled the regional development strategy before the reform of 1978 as the "Maoist development strategy" Influenced by socialist ideology, the government sought egalitarian goals since the first day. The central government hammered at unequal regional development using redistribution as a tool to bring more equal development. However Tsui's empirical studies showed that redistribution efforts of the central government before the 1980s did not contribute much to narrowing the regional gap (Tsui, 1991)

Beginning with economic reforms in 1978, China's dominant development strategy was changed. The new strategy was called the "uneven development strategy" by Yang (1990). In 1984 the government began advocating a ladder-step theory-- a Chinese version of the growth pole[10] and inverted-U theories[11] – by issuing the "Decision of the Chinese Communist Party Central Committee on Reform of the Economic System" (Central committee, 1984). This reform permitted further unequal distribution of income--at least initially. The justification for this policy was that poorer areas would begin to benefit as richer areas began to profit because the growth and riches would then trickle down to these poorer regions and start the process of growth there. So the government encouraged certain regions to 'get rich quick'. It also emphasized the development of coastal regions (Yang, 1991).

This strategy that favors coastal regions has often been blamed for the rise of regional gaps and conflicts. Researchers argued that more resources should be committed to the development of the poorer interior regions to reduce regional inequality. However, other researchers argue instead that widening regional gaps are inevitable because China should pursue the goal of economic efficiency, and that diffusion would facilitate the development of poorer regions and would reduce regional inequality (Lu, 1991; Wei, 1992).

Lin (1996) also argues that economic reform in China followed a gradualist approach with the "Pareto-improvement characteristic". According to Lin, the Chinese government tried to improve incentives and microeconomic efficiency first, and then focused on the allocation of newly created resources to more

productive sectors. The Chinese government tried to make "the cake" bigger first and focus on slicing it up later. This is a typical growth ideology that many developing countries share in distinction to a development policy that is concerned about the distribution of income.

As a result, inequality in China has jumped sharply since 1992. Li's measures of the Gini coefficient (Li, 2000) discussed above show the regional pattern of rising inequality, between 1989 and 1996. Galbraith also found that inequality has gone up everywhere, but much more in the North and West than in the relatively prosperous southern and coastal regions or Beijing. (Galbraith, 2000)

2.3.2 Input of capital

In neo-classical growth theory, capital is expected to flow from rich to poor areas and thereby accelerate the process of convergence.

Chow (1993) discussed how physical capital formation in the national economy and the five productive sectors of agriculture, industry, construction, transportation, and commerce contributed to economic growth. He found that, with the development strategy of a high rate of capital accumulation at the expense of consumption and the promotion of industry at the expense of agriculture, capital formation played an important role in the growth of the Chinese economy from 1952 to 1980. However, he did not include an education

variable because data on the level of education for his time-series analysis is not available.

Led by Schultz(1960,1961) the role of education in economic development has been increasingly emphasized in economics. Lucas (1998) developed an endogenous growth model which emphasized the external effects of human capital. He showed that human capital is the engine of economic growth. O'Rourke and Williamson (1995) found that schooling mattered to economic growth in the European peripheral nations. Lau, Jamison, and Louat (1990) and Lau, Jamison, Liu, and Rivkin (1993) found a positive relationship between education and economic growth based on the evidence from developing countries. Also, Lipton (1977) emphasized the role of education in transferring people from agriculture to industry and argued that usually only the most able and educated young rural people could move to industry. However, his analysis of Chinese economic development is rather limited, despite the fact that China is the fastest growing country in the world.

Evidence provided by Lin (1997) indicates that education is crucial for economic development. He asserts that provinces with the higher average years of schooling have higher growth rates of real per capita GDP in the subsequent years. Having only a primary education seems insufficient to enable laborers to move from the agricultural sector to the industrial sector. (Lin 1997)

According to Men Mingyi, a Chinese specialist on higher education research in Beijing, the main reason for underdevelopment in Chinese society and the economy is the poor quality of the workforce (Hayhoe, 1992). The first

implication of the idea is that the overall level of educational achievement is low when measured by graduation certificates.

Besides educational attainment, a high rate of illiteracy is responsible for underdevelopment in many regions. The negative effects of illiteracy on the economy are more significant to agriculture than other sectors since the majority of illiterates are residents of rural areas. Tsui (1991) did research on comparison of per capita output, infant mortality rate and illiteracy rate, and found there is negative relationship between illiteracy rate and per capita output.

2.3.3 Openness Level

Some research effort has been made to examine the impact of openness on growth. Openness is the extent the country interacts economically with the international community through trade and investment.

Stoneman (1975) attempted to test the impact of foreign capital on the by performing a examining the impact of several variables on growth rates. He found that, foreign direct investment had a small effect on growth but this conclusion was not one that could be made with confidence. Other types of inflows had a strong positive and highly consistent impact.

Reynolds (1987) pointed out that foreign investment and trade increased regional inequality in China. The concentration of trade and foreign investment in the coastal areas gave them advantages. When areas were permitted a portion of foreign exchange from trade, area income was boosted.

Although China as a whole has achieved great progress in attracting foreign investment and expanding international trade, comparative performance among China's provinces has been unbalanced. Chen et al. (1995) found that FDI was positively associated with China's economic growth. They also investigated the effect of FDI on regional disparity and income distribution, and find that the positive relationships between them exist.

2.3.4 Industrialization

The effects of industrialization process on economic growth have been concerned by various researchers.

Tsui (1993) based his research on data at the county level and decomposed regional disparities into intra-province disparity, inter-province disparity, internal disparity of the rural areas, internal disparity of the urban areas, and rural-urban disparity. He found that the rural-urban disparity had the strongest impact on regional inequalities.

Young (2000) shows that while labor intensity and yields were positively correlated under the plan, this relationship completely disappeared during the reform period, as the provinces with the highest agricultural yields shed labor. These results are consistent with a movement toward regional autarky.

Yang (1999) shows that increases in rural-urban income differentials have been the driving factor behind the rising overall inequality in China. He argues that urban-biased policies and institutions, including labor mobility restrictions,

welfare systems, and financial policies of inflation subsidies and investment credits to the urban sector, are responsible for the long-term rural-urban difference and the recent increases in disparity.

The studies mentioned above are essential because they provide a broad background of research on the topic of convergence, and also offer a clear understanding of the factors impact on regional economic growth. However, these studies provide only a partial view of the convergence process in China.

Based on existing research results, this study will provide a more accurate description of the trend of regional disparities in China since the reform in 1978 and to reveal the economic causes affecting the trend.

The hypotheses are that (1) changing policy emphasis by the government will affect convergence and that (2) the factors that influence convergence themselves will change after 1990.

Chapter 3

Methodology

The purpose of this study is to examine the convergence of China's provincial incomes after reformation in 1978 and identify the factors affecting the trend.

The method needs elaboration.

3.1 Method

A first step in the estimation of a model is an appropriate specification of the variables. The most commonly used measure of economies' economic condition is GDP (Gross Domestic Product) per capita. All other variables are selected based on theoretical considerations and the results of previous studies.

3.1.1 Descriptive Statistics and σ-convergence

I will use descriptive statistics to outline the σ-convergence trends. The coefficient of variation will be used to compare the dispersions of GDP per capita within provinces over several years.

Different years are regarded as groups: $group_t$, where t= 1952, 1953... 2002.

In each group, the 28 provinces' GDP per capita should be regarded as elements of the population.

The coefficient of variation will be estimated by this equation:

$$\sigma_t = d_t / \mu_t = \frac{\sqrt{\frac{\sum_{i=1}^{28} GDP_{it}}{28} - \mu_t^2}}{\mu_t} \qquad (4)$$

where σ_t is the coefficient of variation for the population in year t, d_t is the standard deviation for the population in year t, and μ_t is the mean of the population in the year t, and GDP_{it} is the per capita GDP for province i in year t.

If $\sigma_{t+T} < \sigma_t$, σ-convergence exists.

After the estimation, I'll graph the result to identify turning points and trends in σ-convergence, and then divide up periods.

I hypothesize that after reformation, dispersion will increase at first and then decrease.

3.1.2 Linear Regressions of β-convergence

Even though σ-convergence and β- convergence capture two different aspects of the world, they relate to each other. Figure 1a to figure 1c show the three possibilities of the relationship between σ- convergence and β-convergence. A and B are two economies with different initial levels of income. Economy A is richer than economy B in the initial year t.

Figure 1a, if economy B grows faster than economy A within period t to t+T, β-convergence exists. At the same period, the dispersion of Ln(GDP) is getting smaller from time t to t+T, σ-convergence exists.

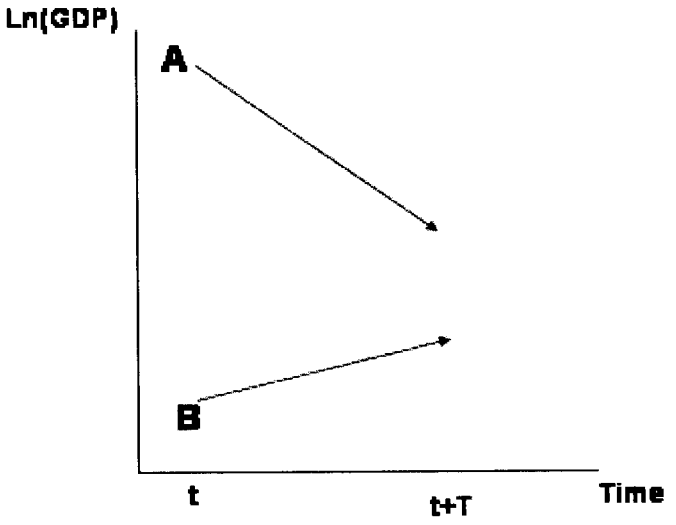

Figure 1a: The relation between σ-convergence and β-convergence: β - convergence associate with σ-convergence

Figure 1b, economy A grows faster than economy B within period t to t+T, β-convergence doesn't exist. At the same period, the dispersion of Ln(GDP) is getting greater from time t to t+T, σ-convergence doesn't exist.

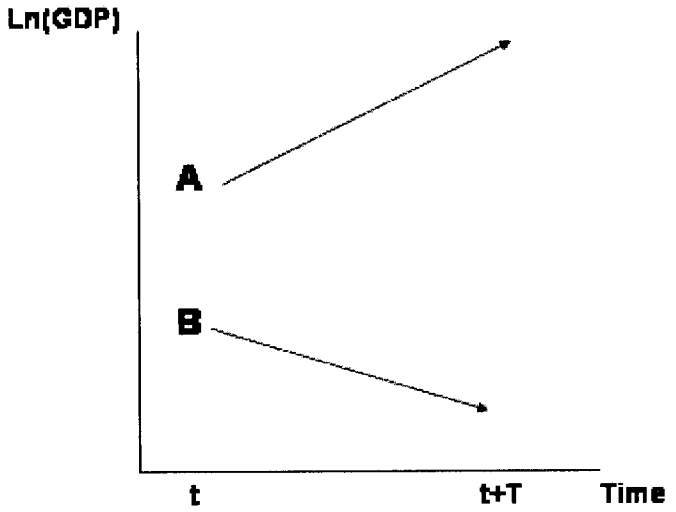

Figure 1b: The relation between σ-convergence and β-convergence: lack of β-convergence associate with σ-convergence

Figure 1c, poor economy B grows faster than rich economy A within period t to t+T, β-convergence exists. At the same period, the dispersion of Ln(GDP) is getting smaller at the beginning and getting greater later. From time t to t+T, the dispersion doesn't change. So σ-convergence doesn't exist.

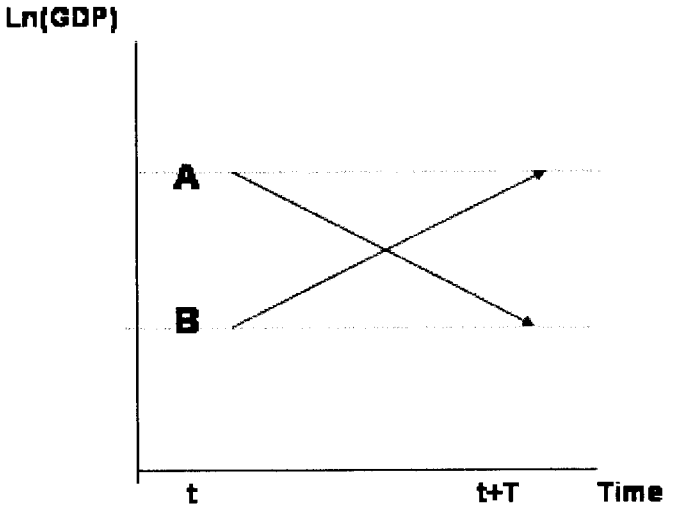

Figure 1c: The relation between σ-convergence and β-convergence: β-convergence doesn't associate with σ-convergence

The existence of β- convergence is the necessary but not sufficient condition of the existence of σ- convergence. This means, if σ- convergence exists, one may assume β-convergence exists.

Using linear regression of growth rate on initial GDP, I will analyze β-convergence and its causes during the sub-periods I got from σ-convergence analysis.

Regression is the most frequently used statistical method in economics. In regression the association between independent variables and a dependent variable is explored. If when the independent variables change in one direction, the dependent variable consistently changes in the same direction, the variables are thought to be directly related. When the independent variable moves in one direction and the dependent variable moves in the opposite direction, the variables are thought to be indirectly or inversely related. Whether there is

causality cannot be determined by the statistical procedure; only by theory can causality be implied. Thus when two variables move together in the same direction, it may occur by chance, one may be causing the other to change, or both may be changing as a result of outside factors. Regression is performed by the least squares method of fitting a line to a number of points. This procedure gives a line that best describes the relationship between the points in time or space. The points represent observations of independent and dependent variables that occur together in time or in space. When we drive a car, for example, we can measure the miles traveled at each distance and also measure the gasoline used. We can infer by theory that greater travel distance away from the starting point is causing gasoline use to increase. We then could place these points on a graph called a scatter diagram with distance driven on horizontal axis and gasoline used on the vertical axis. Each point would represent an observation of gasoline used associated with distance driven. Least squares could help us determine a trend line which shows the functional relationship between miles driven and gasoline used. The line in the case of the gasoline example would be positively sloped suggesting that as we drive more miles, more gasoline will be used. I will be using this procedure in what follows.

The function I will use is:

$$RATE_i = f(GDP_{it}) \quad \text{.....(5)}$$

The growth rate for province i for T years beginning in year t is:

$$RATE_I = \left(\frac{GDP_{i(t+T)}}{GDP_{it}}\right)^{1/T} \quad \text{.....(6)}$$

where GDP_{it} is GDP per capita of province i at initial year t, $GDP_{i(t+T)}$ is GDP per capita of province i at end year t+T, T is number of years from initial to end year

Substitute RATEi in (5) by equation (6)

$$f(GDP_{it}) = (\frac{GDP_{i(t+T)}}{GDP_{it}})^{1/T} \quad \text{.....(7)}$$

Because RATE is a rate while GDP_{it} is not, I take the natural logarithm of each variable.

The specified form is:

$$Ln(RATE_i) = \alpha + \beta Ln(GDP_{it}) + \varepsilon_{it} \quad \text{.....(8)}$$

where ε_{it} is the error item.

If $\beta<0$, absolute β-convergence exists during this period; if $\beta>0$, absolute β-divergence exists during this period.

After considering absolute β convergence, I will explore the theory and empirical results of conditional convergence—what conditions might be responsible for convergence.

3.2 The Data

There are four major sources of data used in the tests by this paper. Data on the GDP and GDP per capita from 1952 to 1995 were taken from China's National Income by Hsueh in 1999 who based his statistics on data taken from various issues of the China Statistical Yearbook.

Data on the GDP and GDP per capita after 1995 were taken from the official website of China National Statistic Bureau (http://www.statistic.gov.cn)

Data on other variables from 1978-1989 were taken from China's Provincial Statistics (Hsueh, 1993), who based his statistics on data taken from various issues of the China Statistical Yearbook.

Data on other variables after 1989 were taken from the website of Chinese Economics Association (http://www.down.cenet.org.cn)

Data on Education level was not available for the period of 1978 to 1990, and so I was forced to drop this important factor for this period.

For each of the regressions there are 28 observations, one for each province but Hong Kong, Macao, and Taiwan were omitted because they are relatively independent of the Chinese economic system; Tibet was also omitted due to insufficient data.

Hainan became an autocephalous province only from 1985; Congqing became an independent municipality only from 1996. Thus for consistency, Hainan's data was integrated with Guangdong province's, and Congqing city's data was integrated with Sichuan province's[12].

Although data before 1949 is obtainable, I used data beginning with 1952, the earliest year data was available for "New China" (the People's Republic of China). Before 1949, China had a totally different social, political, and economic system.

Chapter 4

Results and Analysis

Table 4.1 shows maximum, minimum, mean, standard deviation, and coefficient of variation for the 28 provinces for each year from 1952 to 2001. Alone, these descriptive statistics reveal interesting characteristics concerning the economy.

4.1 Identification of Periods with Different Convergence Trends

Table 1: Descriptive Statistics

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variation
1952	28	58	436	134.8929	81.05477768	0.600883
1953	28	66	590	164.4643	119.5319521	0.726796
1954	28	72	580	173.1429	116.6510194	0.673727
1955	28	74	589	179.9286	116.4734682	0.647332
1956	28	91	681	202.5714	133.6200885	0.65962
1957	28	99	713	210.8214	144.1133951	0.68358
1958	28	113	952	252.3929	186.578221	0.739237
1959	28	122	1268	297.6786	250.9104981	0.842891
1960	28	30	1521	305.0714	302.858961	0.992748
1961	28	96	966	222.6071	178.1963834	0.800497
1962	28	88	803	205.6786	144.3070424	0.701614
1963	28	85	851	215.9643	154.0140643	0.713146
1964	28	101	933	235.5	168.8739394	0.717087
1965	28	122	1042	262.8214	187.3774273	0.712946
1966	28	127	1140	283.7143	206.4530898	0.72768
1967	28	122	999	255.0357	176.7562628	0.693065
1968	28	108	1113	242.8929	199.2839663	0.82046
1969	28	102	1292	276.8571	240.732634	0.869519
1970	28	132	1446	318.2143	277.1670652	0.871008
1971	28	145	1541	335.5357	288.6615963	0.860301
1972	28	129	1605	342.75	301.9014587	0.880821
1973	28	119	1737	360.4643	328.065766	0.91012
1974	28	101	1905	372.9643	366.5031436	0.982676
1975	28	124	1898	394.3929	371.6447267	0.942321
1976	28	110	1929	386.6786	375.4149362	0.970871
1977	28	144	2125	417.5357	404.0876768	0.967792

1978	28	175	2498	476.25	471.2489807	0.989499
1979	28	204	2568	521.0714	484.8656117	0.930517
1980	28	219	2738	571.3214	524.3549161	0.917793
1981	28	242	2813	603.2857	527.4995424	0.874378
1982	28	278	2877	652.5	540.2541583	0.827976
1983	28	302	2963	719	568.2638928	0.790353
1984	28	371	3259	839.25	635.6378322	0.757388
1985	28	420	3855	999.3214	746.576783	0.747084
1986	28	467	4008	1100.714	787.6802725	0.715608
1987	28	546	4396	1268.464	867.1488181	0.683621
1988	28	683	5161	1559.321	1021.579679	0.655144
1989	28	750	5489	1725.75	1086.808874	0.62976
1990	28	810	5910	1889.179	1158.932173	0.613458
1991	28	896	6955	2143.179	1377.930092	0.642938
1992	28	1034	8652	2580	1698.437517	0.658309
1993	28	1255	11700	3341.5	2260.266331	0.676423
1994	28	1553	15204	4352.571	2936.653858	0.674694
1995	28	1853	18943	5436.857	3688.722349	0.678466
1996	28	2093	22275	6376.821	4315.493166	0.676747
1997	28	2215	25750	7114	4956.473605	0.696721
1998	28	2342	28253	7648.643	5471.695277	0.715381
1999	28	2475	30805	8085.893	5988.059268	0.740556
2000	28	2662	34547	8919.857	6783.383089	0.760481
2001	28	2895	37382	9735.536	7456.868002	0.765943
2002	28	3140	40627	10646.93	8125.148354	0.763145

Plotted below in Figure 1 is the coefficient of variation taken from column 7 in Table 4.1 of per capita incomes among the provinces between 1952 and 2002.

The table suggests that the coefficient of variation changes over time, but there are some obvious trends during certain periods.

From 1952 to 1977 is the pre-reform period. In this period, the coefficient of variation fluctuates much more than during the post-reform period.

Roughly speaking, there are 5 sub-periods before reformation: 1952-1960, increasing of variation; 1960-62, strongly decreasing variation; 1962-1967, no significant change of variation; 1967-1974 increasing of variation; 1974-1978, no significant change over time. (See table 1 & figure 2)

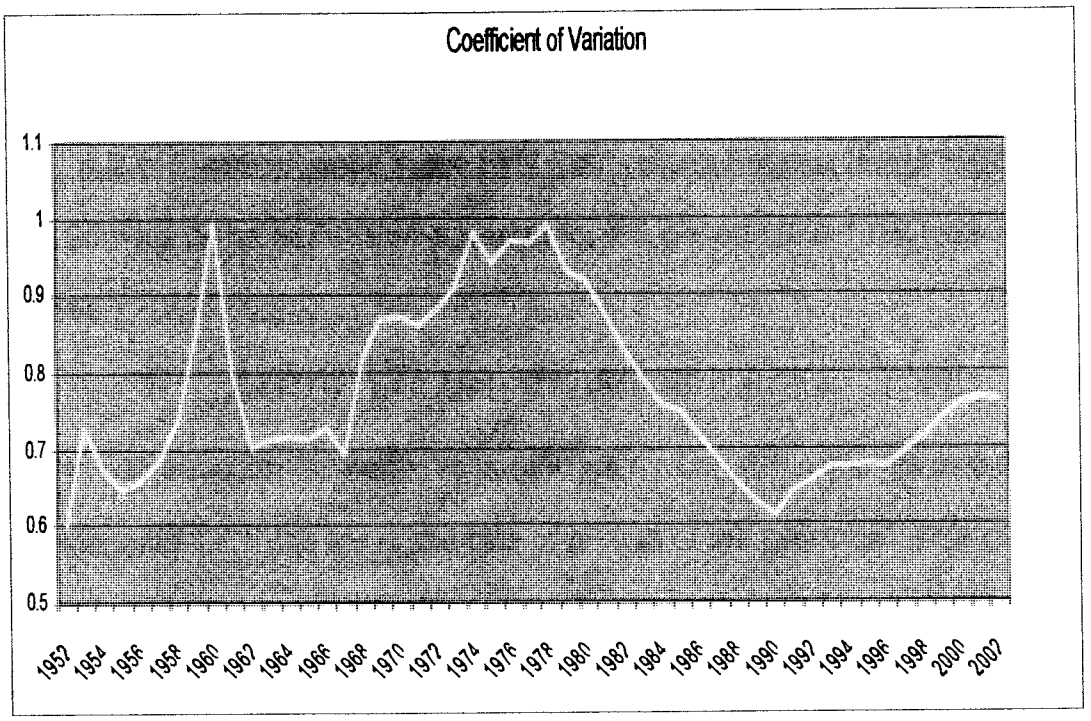

Figure 2: Coefficient of Variation for Per Capita Incomes among the Provinces Between 1952 and 2002

Focusing on the convergence during post-reformation period, this paper will not perform any analysis on the pre-reform period.

From 1978 to date is the post-reform period. Table 4.1 and Figure 4.1 show an obvious delimitation of σ-convergence trend periods: from 1978-1990, a period with significant decrease of variation; from 1990-2001, a period with significant increase of variation.

4.2 β-convergence in Two Post-reform Periods

4.2.1 β-convergence in the First Post-reform Periods (From 1978-1990)

So here is the regression equation for the period 1978-1990 from equation (8) above.:

$$Ln(RATE_i) = 0.2531 - 0.0218Ln(GDP_{it}) \qquad (9)$$

In this equation the negative coefficient for Ln(GDP_{it}) implies that the larger the initial GDP the lower the rate of growth of the province. This confirms β convergence during 1978 through 1990. Tables 2 to 4 reports the estimation results of regressions designed to examine this relation. The results suggest a β-convergence speed of 0.0218 (Table 2). The P-value of the coefficient measures the fraction of time with random data that this kind of statistical result would occur by chance. In Table 2 below the Sig Column (significance) gives the P-value as .000139 which means that this kind of result would occur by chance 1.39 times in 10,000. This is a reliable relationship and is said to be signficant at the 0.1 percent level.

Table 2 Coefficients for period 1978-1990 Equation (8)

Model		Coefficients		t	Sig.
		B	Std. Error		
1	(Constant)	0.25312816	0.0291989	8.669098	3.8E-09
	LnGDP	-0.0218268	0.00489266	-4.46114	0.000139

The ANOVA table (Table 3) below shows the overall significance of the equation in column 6. These results confirm the result in Table 2. This means

that data like this would occur by chance when there was no association between variables only once in slightly under ten thousand times. This is an acceptable level of risk so that I can conclude there is a strong relationship among the independent and dependent variables during this period.

Table 3: ANOVA Table for Period 1978-1990 Equation (8)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.004325265	1	0.004325	19.90174	0.0001394
	Residual	0.005650607	26	0.000217		
	Total	0.009975872	27			

Table 4 shows another set of measures of association, the R square, adjusted R square and the Standard Error of the Estimate. The R square is the percentage of sum of squares of deviation from the mean of the dependent variable "explained" or accounted for by changes in the independent variables. This is a measure of how closely the regression line fits the points in the scatter diagram. In this case 43 percent of the sum of squares of the deviation from the mean was accounted for by the regression line. This is a fairly strong statistical relationship. The standard error of the estimate is relatively low.

Table 4: Model Summary for Period 1978-1990 Equation (8)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.65846233	0.433572646	0.41178698	0.014742

Now I shall consider convergence during the second period, from 1990 to 2001.

4.2.2 β-convergence in the Second Post-reform Periods (From 1990-2001)

Here is the regression equation for the period 1990-2001 using equation (8). The positive coefficient for Ln(GDP_{it}) suggests that there was β divergence during the period.

$$Ln(RATE_i) = 0.0052 + 0.02Ln(GDP_{it}) \qquad (10)$$

This implies that provinces with greater GDP in the initial period grew at a faster rate than provinces with lower GDP. . In Table 5 below the Sig Column (significance) gives the P-value as .0046417 which means that this kind of result would occur by chance 4.6417 times in 1,000. This is a reliable relationship and is said to be signficant at the 1 percent level.

Table 5: Coefficients for period 1990-2001 Equation (8)

	Coefficients		t	Sig.
	B	Std. Error		
(Constant)	-0.0052112	0.0478379	-0.1089353	0.9140902
LnGDP	0.0199254	0.0064332	3.0972658	0.0046417

The ANOVA table (Table 6) below shows the overall significance of the equation in Column 6. These results confirm the result in Table 4.5. This means that data like this would occur by chance when there was no association between variables only once in slightly under one thousand times. This is an acceptable level of risk so that I can conclude there is a strong relationship among the independent and dependent variables during this period.

Table 6: ANOVA Table for Period 1990-2001 Equation (8)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.0022866	1	0.0022866	9.5930557	0.0046417
Residual	0.0061975	26	0.0002384		
Total	0.0084841	27			

Table 7 shows another set of measures of association, the R square, adjusted R square and the Standard Error of the Estimate. The R square is the percentage of sum of squares of deviation from the mean of the dependent variable "explained" or accounted for by changes in the independent variables. This is a measure of how closely the regression line fits the points in the scatter diagram. In this case 24 percent of the sum of squares of the deviation from the mean was accounted for by the regression line. This is a fairly strong statistical relationship but not as strong as in the previous period analysis above. The standard error of the estimate is relatively low but not as low as in the previous period analysis.

Table 7: Model Summary for Period 1990-2001 Equation (8)

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.5191536	0.2695204	0.2414251	0.0154391

Of interest is why there was divergence in period 2 and convergence in period 1. To answer this question I will explore conditional convergence.

Chapter 5

Conditional Convergence

To test the hypothesis of conditional convergence[13], I'll try to achieve a steady state by controlling for factors in each regression that may cause significant change in the way the economy functions.

5.1 Regressions for Conditional β-Convergence

To find the factors that can explain the convergence of provincial economies, the following variables will be used as independent or potentially causal variables for the dependent variable growth : investment share in GDP(IGR), population growth(POP), physical capital (INV); human capital (EDU); urbanization level (UPOP); openness level(FINV & TRAD); industrialization speed (IND); agricultural share of total output (AGRC); state-share of industrial output (SOE); geography (East & West).These variables have been chosen

based on previous studies[14] and simply theory[15]. I hypothesize that each of these variables should be directly related to GDP growth. This means that when each of these variables increase, GDP growth should increase. In order to capture the differential economic impact of geography among East provinces, Center Provinces, and West provinces, I will use dummy variables. This means that when the regression concerns the East, all other provinces will have a zero for this dummy variable, but the East will have a one. This allows us to see if the regression equation is different for the East than for other provinces.

After identifying these important variables[16], I will use a procedure called backward stepwise regression to find the best model for both periods. In this procedure, the statistical package will eliminate variables that have the least impact on the dependent variable one by one. Thus the variables where association seems weakest are eliminated from the regression equation.

The initial or complete equation is:

$$LnRATE_i = \alpha_0 + \alpha_1 LnGDP_{it} + \alpha_2 LnIGR + \alpha_3 LnPOP + \alpha_4 LnINV_i + \alpha_5 LnEDU_i + \alpha_6 LnUPOP_i + \alpha_7 LnFINV_i + \alpha_8 LnTRAD_i + \alpha_9 LnIND_i + \alpha_{10} LnAGRC_i + \alpha_{11} LnSOE_i + \alpha_{12} East + \alpha_{13} West \quad (9)$$

where

$RATE_i$ the economic growth rate for province **i** during the period, represented by the GDP per capita in final year **(t+T)** over GDP per capita in initial year **t** to the power of **1/T**

GDP_{it} Initial year's economic condition for province **i**, represented by the GDP per capita at initial year **t** of this period

POP_i	Growth rate of population for province i
IGR_i	Investment GDP ratio for province i
INV_i	physical capital for province **i** during the period, represented by the Fixed assets investment
EDU_i	human capital for province i, represented by the percentage of population educated by secondary education and over
$UPOP_i$	the urbanization level of province **i**, represented by the percentage of urban population
$FINV_i$	openness level of province i, represented by the ratio of the amount of foreign investment utilized over GDP
$TRAD_i$	openness level of province i, represented by the ratio of the total trade over GDP
IND_i	industrialization speed of province i, represented by the growth rate of ratio of manufacturing output divided by total output
$AGRC_i$	the agriculture share of total output in province i, represented by the ratio of agricultural output over total output

SOE	state-share of industrial output in Province i, represented by state-owned enterprise output divided by total industrial output
East	Dummy variable for geographic location. East=1 for the11 east coast provinces[17], otherwise it is 0.
West	Dummy variable for geographic location. West = 1 for the 8 western provinces[18], otherwise it is 0.

The Hypotheses are:

$\alpha_1 < 0$ for the initial period of reformation. Since σ-convergence exists, β-convergence should exist also

$\alpha_{10} > 0$ for the initial period because the reformation in China began with a very successful agricultural reform

$\alpha_{11} < 0$. because State Owned Enterprise is less successful than private enterprise after the market reform.

$\alpha_{12} > 0$, $\alpha_{13} < 0$. because China espoused "let some region get rich first" as a means to achieve the goal of "getting rich together". Thus the government began a policy of favoring the East coast region.

All of other coefficients α_2, α_3, α_4, α_5, α_6, α_7, α_8, and α_9 are greater than zero.

After performing the original regression, insignificant explanatory variables will be eliminated one by one by the stepwise regression procedure, until all the explanatory variables in the equation will be significant. Then I will test for

multicollinearity and heteroscedasticity. If multicollinearity and heteroscedasticity are present in the model, the regression procedure is invalidated because the test results are no longer reliable. Multicollinearity exists if the independent variables are strongly related to each other. In this case the regression procedure cannot distinguish which variable is associated with changes in the dependent variable because the independent variables both change at the same time. When heteroscedasticity exists, the regression tests are no longer reliable because the assumption of randomness made in all statistical procedures is violated and this means that probability estimates are no longer valid. I will test to see if these assumptions are violated to assure that regression is a viable procedure.

The Statistical Package for the Social Sciences (SPSS,) will be used to estimate these models but I will describe the data used in the regressions first.

5.2 Analyses of Conditional Convergence

5.2. 1 Conditional Convergence During 1978-1990

The results of the regression for conditional convergence is shown below in Table 8. In column 2 are the coefficients and significance of equation (11) without elimination of insignificant variables through reverse stepwise regression. In column 3 are the coefficients and significance of equation (11) after stepwise regression.

Table 8 shows the coefficients of independent variables in the multiple regression models. The P-value on the coefficients is also included.

After dropping all the insignificant independent variables the equation is :

$$LnRATE_i = 0.520 + 0.072LnGDP_{it} + 0.346LnIND_i - 0.038LnAGRC_i + 0.015LnTRAD - 0.122LnPOP_i \quad (12)$$

Table 8 shows that F=1242.397 >>2, the significance of the overall equation (0.000) is impressive. The F test of this model rejects the null hypothesis H_0 that all coefficients equal 0. R square is 0.9969. Thus 99.69% of the deviations from the mean of these observations have been explained by this model. This is highly significant and we can be sure there is association between the dependent and independent variables.

Table 8: Coefficients and Significances Equation (11)

	Initial Equation	After Stepwise Regression
LNGDP	-0.0723	-0.0693
p-value	0.0000*	0.0000*
LNIND	0.3463	0.3064
p-value	0.0427**	0.0223**
LNTRAD	0.0154	0.0144
p-value	0.0095*	0.0000*
EAST	-0.0055	
p-value	0.6396	
LNINV	0.0064	
p-value	0.2188	
WEST	-0.0029	
p-value	0.7046	
LNFINV	-0.0010	
p-value	0.5340	

LNAGRC	-0.0381	-0.0339
p-value	0.0325**	0.0053*
LNSOE	0.0030	
p-value	0.7369	
LNUPOP	0.0120	0.0109
p-value	0.1437****	0.1033****
LNIGR	0.0116	
p-value	0.4034	
LNPOP	-0.1221	-0.1513
p-value	0.3834	0.1560
R2	0.9974	0.9969
F	537.043	1242.397

* significant at 1% level
** significant at 5% level
*** significant at 10% level
****significant at 15% level

Empirical analysis suggests that some independent variables in the original model, such as the dummy variable for East and West, foreign investment, and the output by state owned enterprise as a percentage of total output, are not significant determinants of the growth of economy.

Analysis also indicates a significant positive relation between the economic growth and INV, and TRAD, a significant negative relationship between economic growth and AGRC. POP is slightly insignificant to RATE, but I retained it in the model anyway because of its economic importance. To assure that regression was an appropriate procedure, I will test for multicollinearity and heteroscedasticity.

Multicollinearity Test:

As discussed above, multicollinearity exists when there is such a strong relationship between independent variables that it invalidates regression as a

procedure. If the overall correlation coefficient in the model is substantially less than the correlation coefficents between independent variables, there is an indication that multicollinearity exists.

Table 9: Model Summary

		Model Summary	
Model	R	R Square	Adjusted R Square
1	0.998461	0.996924	0.996122
a	Predictors: (Constant), LNPOP, LNUPOP, LNAGRC, LNTRAD, LNGDP, LNIND		

Table 10: Correlation Coefficients

		LNPOP	LNUPOP	LNAGRC	LNTRAD	LNGDP	LNIND
Correlations	LNPOP	1	0.210798	-0.66539	-0.202566543	-0.75688	0.991019
	LNUPOP	0.210798	1	0.263691	-0.378101643	0.187746	0.247751
	LNAGRC	-0.66539	0.263691	1	0.365117506	0.947431	-0.62915
	LNTRAD	-0.20257	-0.3781	0.365118	1	0.406893	-0.20821
	LNGDP	-0.75688	0.187746	0.947431	0.406893349	1	-0.7099
	LNIND	0.991019	0.247751	-0.62915	-0.208209802	-0.7099	1

Comparing the correlation coefficients (r) in table 10 with the multiple R for the regression (0.998) in the Model Summary table above, indicates no multicollinearity is found between the independent variables.

Heteroscedasticity Test:

A heteroscedastic error variance means the assumption of constant variance does not hold for ordinary linear regression and this invalidates an assumption of randomness and thus invalidates regression as an acceptable procedure.

Table 11: ANOVA Table White test

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.76E-08	5	3.52E-09	0.255995698	0.932565
	Residual	3.3E-07	24	1.37E-08		
	Total	3.47E-07	29			
a	Predictors: (Constant), POP2, AGRC2, TRAD2, GDP2, IND2					
b	Dependent Variable: RES2					

From the White test, the paper finds a value for the F statistic is 0.256<<2, significance is 0.9326>>0.05. This result shows the model is not heteroscedastic, but instead is homoscedastic. Thus the assumptions of regression are met and it is a viable procedure.

5.2.2 Analyses of Factors for Divergence During 1990-2001

Using a similar procedure, I tested for conditional convergence in the latter period under consideration. In Table 12 below in column 2 is the original equation (9) with all the conditional variables included. Also shown are their significance levels. In column 3 are the coefficients and their P values after reverse stepwise regression eliminated insignificant variables

Table 12 shows the coefficients of independent variables in the multiple regression models. The significances of the coefficients are also included.

Here is the final equation after dropping all the insignificant independent variables:

$$LnRATE_i = -0.242 + 0.047LnGDP_{it} + 0.013LnAGRC_i - 0.023LnUPOP_i - 0.349LnIND_i + 0.013LnAGRC - 0.03LnSOE \quad (13)$$

. Table 12 shows that F=38.294 >>2, the significance of the overall equation is (0.000) impressive but not as impressive as the previous results, The F test of this model rejects the null hypothesis H_0 that all coefficients equal 0. Thus we can put confidence in the conclusion that there is a relationship between the independent variables and the dependent variables. R square is equal to 0.897. Thus 89.7% of the deviations from the mean of these observations have been explained by this model.

Table 12: Coefficients and Significances

	Initial Equation	After Stepwise Regress.
LNGDP	0.0547	0.0467
	0.0067*	0.0000*
LNEDU	0.0049	
	0.7604	
EAST	-0.0005	
	0.9302	
LNIGR	0.0065	
	0.6824	
LNPOP	0.2227	
	0.5067	
LNINV	-0.0025	
	0.5667	

LNFINV	0.0020	
	0.4811	
LNTRADA	-0.0066	
	0.3213	
WEST	-0.0111	
	0.3558	
LNAGRC	0.0132	0.0125
	0.1079***	0.0320**
LNIND	-0.2023	-0.3488
	0.2857	0.0001*
LNSOE	-0.0294	-0.0300
	0.0048*	0.0000*
LNUPOP	-0.0295	-0.0229
	0.0016*	0.0001*
R2	0.919	0.897
F	12.274	38.294

* significant at 1% level
** significant at 5% level
***significant at 10% level
****significant at 15% level

Empirical analysis suggests that some independent variables in the original model are not significant in explaining the growth of economy. The analysis also indicates a significant positive relationship between economic growth and the weight of agriculture in the economy; a significant negative relationship between economic growth and the urban population percentage, economic growth and the growth rate of the weight of industry in the economy, and economic growth and the share of output by state owned enterprise in the total out put. during this period. To assure validity of regression as a procedure, I tested for multicollinearity and heteroscedasticity.

Multicollinearity Test:

If multicollinearity exists, the model conclusions are invalidated. If the overall correlation coefficient R is greater than the correlation coefficients r between the independent variables, multicollinearity does not exist.

Table 13: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.947	.897	.874	.00630425 8936114

a Predictors: (Constant), LNUPOP, LNSOE, LNIND, LNAGRC, LNGDP

Table 14: Correlation Coefficients

		LNUPOP	LNSOE	LNIND	LNAGRC	LNGDP
Correlations	LNUPOP	1	-0.48741	0.175565	-0.18853	-0.67231
	LNSOE	-0.48741	1	-0.02837	-0.01445	0.369396
	LNIND	0.175565	-0.02837	1	-0.11234	-0.23706
	LNAGRC	-0.18853	-0.01445	-0.11234	1	0.774895
	LNGDP	-0.67231	0.369396	-0.23706	0.774895	1

Comparing the correlation coefficients in table 14 with the multiple R for the regression (0.947 in the Model Summary table above), it suggests that no multicollinearity exists between the independent variables.

Heteroscedasticity Test:

A heteroscedastic error variance means the assumption of constant variance does not hold for ordinary linear regression and this violates an important assumption of the procedure. Testing for heteroscedasticity is achieved through the White test.

Table 15: ANOVA Table in White Test

A heteroscedastic error variance means the assumption of constant variance does not hold for ordinary linear regression and this violates an important assumption of the procedure. Testing for heteroscedasticity is achieved through the White test.

Table 15: ANOVA Table in White Test

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.82E-09	5	3.63199E-10	0.132565	0.983169
	Residual	6.03E-08	22	2.73977E-09		
	Total	6.21E-08	27			
a	Predictors: (Constant), UPOP2, SOE2, AGRC2, IND2, GDP2					
b	Dependent Variable: RES2					

From the White test, the paper finds a value for the F statistic is 0.1326<<2, significance is 0.9832>>0.05. This result shows the model is not heteroscedastic, but instead is homoscedastic. Thus regression is an acceptable procedure.

5.3 Comparison of Results in Two Periods

Comparing the results from the two periods will help distinguish between conditions for convergence in the two periods. The comparison suggests that those explanatory variables play quite different roles during these two periods.

Table 18: Comparison of Regression Results in Two Periods

Variables	1978-1990		1990-2001	
LNGDP	-0.072253	-0.069287	0.0547	0.0467
p-value	0.000001*	0.000000*	0.0067*	0.0000*
LNEDU			0.0049	
p-value			0.7604	
LNIND	0.346338	0.306382	-0.2023	-0.3488
p-value	0.042685**	0.022258**	0.2857	0.0001*
LNTRAD	0.015357	0.014354	-0.0066	
p-value	0.009511*	0.000011*	0.3213	
EAST	-0.005501		-0.0005	
p-value	0.639586		0.9302	
LNINV	0.006439		-0.0025	
p-value	0.218793		0.5667	
WEST	-0.002863		-0.0111	
p-value	0.704629		0.3558	
LNFINV	-0.000954		0.0020	
p-value	0.533971		0.4811	
LNAGRC	-0.038059	-0.033873	0.0132	0.0125
p-value	0.032498**	0.005258*	0.1079	0.0320**
LNSOE	0.002984		-0.0294	-0.0300
p-value	0.736885		0.0048	0.0000*
LNUPOP	0.011992	0.010880	-0.0295	-0.0229
p-value	0.143709****	0.103294***	0.0016	0.0001*
LNIGR	0.011586		0.0065	
p-value	0.403431		0.6824	
LNPOP	-0.122051	-0.151342	0.2227	
p-value	0.383368	0.155952	0.5067	

* significant at 1% level
** significant at 5% level
***significant at 10% level
****significant at 15% level

INV and AGRC show significant influence on RATE in both periods. However, the signs of these two variables are different for these two periods.

TRAD has an significant positive influence on RATE in period 1, but is insignficant in period 2.

UPOP and SOE have a significant negative influence on RATE in period 2, but an insignificant influence on RATE in period 1.

Chapter 6

Conclusions

The econometric analysis presents both expected and unexpected results.

- While most of the previous research[19] suggests convergence within a single country, I find that China has a different story. From 1978 to 2001, the years I study, 1978 to 1990 was a period of convergence, while from 1991 to 2001 was a period of divergence. This is attributable to ongoing development of government policy. Unlike Europe and the United States, the Chinese modern system is an ever-changing economic and social system far from achieving a relatively stable, mature state that might be described as a "steady state" in growth theory.
- China's leadership is pragmatic and is always changing its economic policy to find what works the best. China has been very successful over the last 50 years in achieving development. Because of policies that are always in flux, it is difficult to analyze its development pattern simply by applying a theory. In my model, I selected state share of provincial output (SOE) and agricultural share of provincial output (AGRC) as independent variables because of their importance in the Chinese reformation. These variables were significant conditions of convergence in one period or the other.

- Another interesting finding is the role of Industrialization speed and agricultural share in provincial GDP. Both have significant effects on growth in the two periods, but with different signs. Different signs imply there are underlying effects not explained by the model that affect agriculture in the two periods.
- Openness level has significant contribution on economic growth during the first period but not in the second period. This might be due to a reversal of the openness policy after 1989.
- Neither location dummy variable EAST nor WEST had a significant effect on economic growth. This is quite different than previous studies.
- During the first period after reformation, incomes per capita in the initially poor provinces drew closer to the incomes per capita in the initially richer provinces. This trend changed during the second period so that during the 1990s there occurred σ-divergence and β-divergence. This doesn't necessarily mean reformation brought about inequality, but it indicates that it is not easy to bring about geographically balanced development.
- Both absolute β convergence and conditional β convergence were explored in previous studies for a variety of regions and countries. The absolute β-convergence model is more appropriate for countries with settled economic and social structure such as U.S. and Europe. But when government plays a large role in transition

such as in China, conditional β-convergence is a more appropriate approach.

I would suggest for further study that policy change is a key to understanding development in China perhaps starting in 1949. Beginning in the year 2000, moreover, the Chinese Government launched a new reformation program called the "Great Western Development". This program will affect convergence. Furthermore, China's joining the World Trade Organization will also affect convergence.

More study is necessary to identify underlying causes of conditional convergence that gave opposite signs for variables in the two periods. These signs suggest that simple approaches to conditional convergence may not be warranted in the future. Further study of panel data "fixed and variable" components would be a good place to begin further analysis.

Appendices

Appendix 1: Province level Administration Regions in China

According to China's administrative division, there are totally 33 province-level divisions, including 22 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions.

Provinces:

Hebei: Called "Ji" for short, Hebei is located north of the lower reaches of the Yellow River in north China. It covers 190,000 square km, with a population of 67.44 million.

Shanxi : Called "Jin" for short, Shanxi is located west of the Taihang Mountains in north China. It covers 150,000 square km, with a population of 32.97 million.

Liaoning: Called "Liao" for short, Liaoning is located in the southern part of northeast China and faces the Yellow Sea and Bohai Sea on the south. It covers 150,000 square km, with a population of 42.38 million.

Jilin: Called "Ji" for short, Jilin is located is the east of northeast China. It covers 180,000 square km, with a population of 27.28 million.

Heilongjiang: Called "Hei" for short, Heilongjiang is located in the northernmost part of northeast China. It covers 460,000 square km, with a population of 36.89 million.

Jiangsu: Called "Su" for short, Jiangsu is located on the lower reaches of the Yangtze River and the Huaihe River along the coast of the Yellow Sea. It covers 100,000 square km, with a population of 74.38 million.

Zhejiang: Called "Zhe" for short, Zhejiang is located in the central part of east China along the coast of the East China Sea. It covers 100,000 square km, with a population of 46.77 million.

Anhui: Called "Wan" for short, Anhui is located in the northwest of east China, with both the Yangtze River and Huaihe River crossing it. It covers 130,000 square km, with a population of 59.86 million.

Fujian: Called "Min" for short, Fujian is located on the southeastern coast of China. It covers 120,000 square km, with a population of 34.71 million.

Jiangxi: Called "Gan" for short, Jiangxi is located south of the middle and lower reaches of the Yangtze River. It covers 160,000 square km, with a population of 41.4 million.

Shandong: Called "Lu" for short, Shandong is located on the lower reaches of the Yellow River, bordering the Yellow Sea and the Bohai Sea. It covers 150,000 square km, with a population of 90.79 million.

Henan: Called "Yu" for short, Henan, which formed the major part of the Central Plains in ancient China, is located on the middle and lower reaches of the Yellow River. It covers 160,000 square km, with a population of 92.56 million.

Hubei: Called "E" for short, Hubei is located north of Dongting Lake on the middle reaches of the Yangtze River. It covers 180,000 square km, with a population of 60.28 million.

Hunan: Called "Xiang" for short, Hunan is located south of Dongting Lake on the middle reaches of the Yangtze River. It covers 210,000 square km, with a population of 64.4 million.

Guangdong: Called "Yue" for short, Guangdong is located south of Nanling Mountain along the coast of the South China Sea. It covers 180,000 square km, with a population of 86.42 million.

Hainan: Called "Qiong" for short, Hainan is located off the southern coast of China and faces Guangdong across the Qiongzhou Strait. Encompassing the Hainan Island, the Xisha Islands, the Nansha Islands and the Zhongsha Islands, it covers 34,000 square km, with a population of 7.87 million.

Sichuan: Called "Chuan" for short, Sichuan is located on the upper reaches of the Yangtze River in the southwest of China. It covers 480,000 square km, with a population of 83.29 million.

Guizhou: Called "Qian" for short, Guizhou is located in the east of the Yunnan-Guizhou Plateau. It covers 170,000 square km, with a population of 35.25 million.

Yunnan: Called "Dian" for short, Yunnan is located on the southern frontier of China. It covers 380,000 square km, with a population of 42.88 million.

Shaanxi: Called "Shaan" for short, Shaanxi is located on the middle reaches of the Yellow River. It covers 190,000 square km, with a population of 36.05 million.

Gansu: Called "Gan" for short, Gansu is located on the middle reaches of the Yellow River. It covers 390,000 square km, with a population of 25.62 million.

Qinghai: Called "Qing" for short, Qinghai is located in the northeast of the Qinghai-Tibet Plateau in west China. It covers 720,000 square km, with a population of 5.18 million.

Taiwan: Called "Tai" for short, Taiwan is located off the southeastern coast of China, faces the Pacific on the east and Fujian Province on the west across the Taiwan Straits, and is bounded on the south by Bash Channel, with the Ryukyu Islands lying to its northeast. Encompassing Jinmen, Mazu and other islands, it covers 36,000 square km, with a population of 22.28 million.

Autonomous regions:

Guangxi: Called "Gui" for short. It is a coast province located at the west of China.

Inner Mongolia: Called "Mong" for short, Inner Mongolia is located at the north of China,

Tibet: Called "zang" for short

Ningxia: Called "Ning" for short. It is located at the northwest of China.

Xinjiang: Called "Xin" for short. It is located at the northwest of China

Municipalities:

Beijing: The capital of China.

Shanghai: Coast city. Shanghai is one of the most important business center in China.

Tianjin: Coast city.

Congqing: Called "Yu" for short, is the largest and most populous of the China's four Municipalities. It is the only municipality to the west of the densely

populated eastern half of China. Chongqing is intersected by the Jialing River and the upper reaches of the Yangtze. It contains Daba Mountain in the north, Wu Mountain in the east, Wuling Mountain in the southeast, and Dalou Mountain to the south.

Special Administrative Regions:

Hong Kong: Relatively independent from China's economic system.

Macau: Relatively independent from China's economic system

References:

Adelman, I. and C.T. Morris (1973). Economic Growth and Social Equity in Developing Countries, Stanford: Stanford University Press.

Barro, Robert J., and Xavier Sala-i-Martin, 1991, *Convergence Across States and Regions.* Brookings Papers on Economic Activity, Washton: Brookings Institution

Barro, Robert J., and Xavier Sala-i-Martin, 1992, *Convergence* Journal of Political Economy, Vol. 100, pp 223-51

Barro, Robert J., and Xavier Sala-i-Martin, 1991, *Regional Growth and Migration: A Japan-United States Comparison.* Journal of Japanese and International Economics, *Vol. 6, pp 312-46*

Borensztein, E., Gregorio J. D., & Lee, J-W. (1998, June). *How does foreign direct investment affect economic growth?* Journal of International Economics 45: pp115-135

Cannon, T. (1990). *Regions.* The geography of contemporary China, London: Routledge, pp28-60

Central Committee of the Communist Party. (1984). Central Committee of the Communist Party on Reform of the Economic Structure. Beijing Review, 28: pp1-104

China National Statistic Bureau: http://www.statistic.gov.cn

Chow, Gregory C. (1993). *Capital Formation and Economic Growth in China,* Quarterly Journal of Economics, Vol. 108, pp809-842

Deng, Xiaoping. (1985). *Reformation is the Self-consummate of Socialist System.* Xin Shi Qi Jing Ji Ti Zhi Gai Ge Zhong Yao Wen Xian Xuan Bian. Beijing: Central Literature Press.

Domar, E. (1957). Essays in the Theory of Economic Growth. Oxford.

Dornbusch, R. Fischer, S. and Startz, R (2001). Macroeconomics. Eighth edition. Boston, McGraw-Hill/Irwin.

Fan, S. (1991). *Effects of technological change and institutional reform on production growth in Chinese agriculture.* American Journal of Agricultural Economics.

Harrod, R. F. (1948). Towards a Dynamic Economics. Macmillan.

Hayhoe, R. (Ed.). (1992). Education and modernization, the Chinese experience. Oxford, UK: Pergamon

Hsueh, T., Li, J., Liu, S. (1993) China's Provincial Statistics, 1949-1989. Boulder: Westview Press.

Hsueh, T., Li, J. (1999). China's National Income, 1952-1995. Boulder: Westview Press.

Hu, Angang, (1999). *China's Biggest Challenge in the New Millenium: High Unemployment.* http://forum50.cei.gov.cn/.

James K. Galbraith (2000). *Sustainable Development and the Open-Door Policy in China.* UTIP Working Paper Number 16. Prepared for the Council on Foreign Relations

Jones, H. G (1976). An Introduction to Modern Theories of Economics Growth. New York, Mcgraw Hill.

Jian, Tianlun; Sachs, Jeffrey and Warner, Andrew. *Trends in Regional Inwquality in China.* China Economic Review, Spring 1996, 7(1), pp 1-21

Knight, John, Song, Lina. (1999) The Rural-Urban Divide Economic Disparities and Interactions in China. New York: Oxford University Press Inc.

Kuznets, S. (1955). *Economic Growth and Income inequality*, American Economic Review, 45,pp1-28

Lardy, Nicholas R. (1998) China's Unfinished Economic Revolution. Washington: Brookings Institution.

Lau, Lawrence J., D.T. Jamison, S. C. Liu, and S. Risvkin. (1993). *Education and Economic Growth: Some Cross-Sectional Evidence from Brazil,* Journal of Development Economics. Vol. 41, pp 45-70

Lau, Lawrence J., D.T. Jamison, and F.F. Louat. (1990). *Education and Productivity in Developing Countries: An Aggregate Production Function Approach*, Working Paper WPS 612,The World Bank, Washington, D.C.

Li, Qiang, (2000). *Presentation on inequality in China at the LBJ School of Public Affairs,* March.

Lin, Shuanglin (1997). *Education and economic development:: Evidence from China.* Comparative Economic Studies. V39n3/4, (Fall 1997): pp66-85

Lipton, Michael. (1977). Why Poor People Stay Poor: A Study of Urban Bias in World Development. London: Maurice Temple Smith.

Lu, D. (1991). *Geography and regional development studies.* Dili Kexue (Geographical Science) 3, pp197-205

Lucas, Robert E. (1988). *On the Mechanics of Economic Development*, Journal

of Monetary Economics, Vol. 22, pp3-42

Mankiw, N. G., Romer, D. and Weil, D. N. (1992). *A Contribution to the Empirics of Economic Growth*. The Quarterly Journal of Economics, May, pp407-37.

O'Rourke, Kevin H., and Jeffrey G. Williamson. (1995). *Around the European Periphery 1870-1913: Globalization, Schooling and Growth*, NBER Working Paper 5392, National Bureau of Economic Research, December

Perroux, F. (1988). *The Pole of Development's New Place in a General Theory of Economic Activity in Higgins*. Regional Economic Development: Essays in Honour of François. Unwin Hyman, Boston, Mass., 48-76.

Sala-i-Martin, Xavier. (1996). The *Classical Approach to Convergence Analysis.* The Economic Journal, 106 (July), pp1019-1036

Schultz, Theodore W. (1960). *Capital Formation in Education*. Journal of Political Economy, Vol. 68, pp571-83

Schultz, Theodore W. (1961). *Investment in Human Capital*. American Economic Review, Vol. 50, pp1-17

Stoneman, Colin. (1975). *Foreign Capital and Economic Growth*. World Development. Vol. 3, No. 1 (1975), p.16

Tseng, W., Rodlauer, Markus . (2003) China, Competing in the Global Economy. International Monetary Fund.

Tsui, K.Y. (1991). *China's Regional Inequality, 1952-1985*,Journal of Comparative Economics, 15, pp1-21

Tsui, K.Y. (1993). *Decomposition of China's Regional Inequalities* , Journal of Comparative Economics, 17, pp600-27

Wei, H. (1992). *The Change of Regional Income Inequality in China.* Jingji Yanjiu (Economic Research) 4, pp61-65

Wei, Y. (1993). *Regional development studies in China: major subjects and recent progress.* Jingji dili (Economic Geography)13, pp1-7

Wei, Y., Ma, L.J.C. (1996). *Changing patterns of spatial inequality in China.* Third World Planning Review 18, pp177-91

Wen, G. J. (1993). *Total factor productivity change n China's farming sector:* 1952-1989. Economic Development and Cultural Change, V42, n1. pp1—41

Williamson, J. G.(1965). *Regional Inequality and the Process of National Development*, Economic Development and Culture Change, 13, p25

World Bank (1995). *China Regional Disparities*, Report No. 14496-CHA, Country Operations Division, China and Mongolia Department, East Asia and Pacific Regional Office.

Yang, D. (1990). *Patterns of China's Regional Development Strategy*, China Quarterly, June, pp230-57

Yang, D. (1991). *China adjusts to the world economy.* Pacific Affairs 64, pp42-64

Yang, Dennis Tao (1999). *Urban-based policies and rising income inequality in China*, American Economic Review v89n2 (May 1999): pp306-310

Young, Alwyn (2000). *The Razor's Edge: Distortions And Incremental Reform in*

the Peoples Republic of China, The Quarterly journal of Economics 115, no 4, pp1091-135

Zhou, Q. (1996*). Interprovincial resource transfers in China, 1952-90.* International Journal of Urban and Regional Research 20, pp571-86

End Notes

[1] In this period, the effective average price increases amounted to a rise of 41.5% for all agricultural products.

2 In "Responsibility System", the commune production teams contract work or output with small groups, households or individuals, linking payment to productivity.

3 In 1980, the Shengzhen, Zhuhai, Shantou and Xiamen Special Economic Zones were created. In February, 1982, the Yangtze River Delta, Zhu River Delta and three other regions in Fujian, Liaonin, and Shandong were opened. May, 1984, 14 additional coastal cities were opened. In 1988, Hainan Island Province -- heretofore a fishing community -- became the largest Special Economic Zone. (Galbraith, 2000)

4 Calculate from National Statistic Bureau. (http://www.stats.gov.cn)

5 Calculate from National Bureau of Statistics of China. (http://www.stats.gov.cn)

6 The nonstate sector, comprising the private sector, urban collectives, and township and village enterprises

7 Calculated from National Bureau of Statistics of China. (http://www.stats.gov.cn)

8 He found that the dispersion of income increased during post-reform period.

9 Please Refer to following sections in 2.3.1 to 2.3.4

10 Francois Perroux 's growth pole theory: Growth does not appear everywhere at the same time; it becomes manifest at points or poles of growth, with variable intensity; it spreads through different channels with variable terminal effects on the whole economy. (Perroux, 1988)

11 In 1955, Simon Kuznets published his famous "inverted U" theory of capitalist evolution: that income inequality rises in the early stages of development, and falls as economies mature.(Kuznets, 1955)

12 Because of the relative small size of Hainan and Congqing, I ignore them when I use the variable of GDP per capita. For other variables, such as: Investment, GDP, Population, Urban Population, Foreign Investment, Trade, Agreculture out put, Industry output, and SOE output, I add the value of it in Hainan to Guangdong, and Chongqing to Sichuan.

[13] Harrod (1934) and Domar (1957)'s model relies heavily in the key assumption that the only difference across countries is their initial levels of capital. However, economies may have different levels of technology, propensities to save, their population growth rates, or other behavioral parameters. Thus, they will have different steady state and the β-convergence hypothesis will not be hold any more. The model argues that, economy's growth rate will decline as the capital stock increases, and go to zero as the economy reaches its steady state, hence, its prediction is that the growth rate of an economy will be positively related to

the distance that separates it from its own steady state. This is the concept know in the classical literature as conditional β-convergence.

14 Please refer to p14: "2.3 The Factors of Convergence"

15 Deriev from neo-classical theory, one may find the determinant of one economy's steady state should include capital over GDP ratio and the growth rate of population.

16 Please refer to Appendix II.

17 There are 11 coastal regions at the provincial level: Liaoning, Hebei, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong, Beijing, Tianjin, Shanghai, and Guangxi

18 There are 8 west regions at the provincial level: Shaanxi, Gansu, Ningxia, Sichuan, Qinghai, and Xinjiang.

19 Please refer to the discussion at p.13