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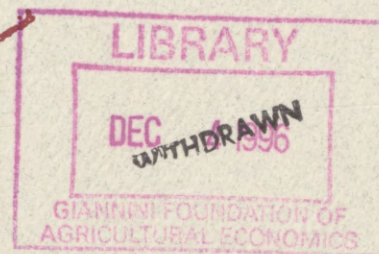
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# Development Discussion Papers



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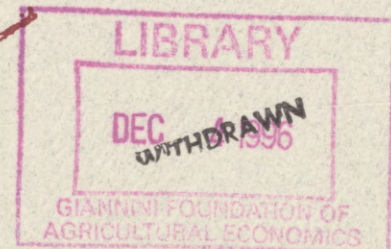
## Development Discussion Papers

### TRENDS IN REGIONAL INEQUALITY IN CHINA

Tianlun Jian  
Jeffrey D. Sachs  
Andrew M. Warner

Development Discussion Paper No. 518

October 1995



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## Abstract

Several recent studies have examined the tendency of regions within a nation to exhibit long-term convergence in per capita income levels. Barro and Sala-I-Martin (1991, 1992, 1995) have found a tendency towards convergence among the U.S. states; among Japanese prefectures; and among regions within Western Europe. In this paper we examine the tendency towards convergence among the provinces of China during the period 1952-1993. We find that real income convergence of provinces in China has been a relatively recent phenomena, emerging strongly only since the reform period began in 1978. During the initial phase of central planning, 1952-1965, there is some evidence for convergence, but it is weak and sensitive to the time period being analyzed. During the cultural revolution, 1965-1978, there is strong evidence of divergence rather than convergence. We find strong evidence for convergence during the reform period is associated with rural reforms, and is especially strong within the coastal regions where there has been liberalization of international trade and investment flows. However, since 1990 regional incomes have begun to diverge. Such a divergence is entirely explained by the variance between the coastal and interior provinces, rather than increase in variance within each other. Therefore, it seems that China is now on a dual track, with a prosperous and fast growing coastal region and a poor interior growing at a lower rate.

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## Trends in Regional Inequality in China

### I. Introduction

Several recent studies have examined the tendency of regions within a nation to exhibit long-term convergence in per capita income levels. Barro and Sala-I-Martin (1991, 1992, 1995) have found a tendency towards convergence among the U.S. states during the period 1840-1980; among Japanese prefectures; and among regions within Western Europe. In this paper we examine the tendency towards convergence among the provinces of China.

The Chinese case is interesting for several reasons. First, China has been subject to several distinctive policy regimes since the establishment of the People's Republic of China (PRC) in 1949. The period 1952-1965 was a period of Soviet-style industrialization under centralized planning, punctuated by the disastrous policy experiment of the Great Leap Forward (1958-1960), by serious nature disasters (1959-1961), and by the break with the Soviet Union and the withdrawal of Soviet aid. The period 1966-77 was the period of the Cultural Revolution, in which the centralized bureaucracy was virtually destroyed by internal political upheaval, and in which independent regions were forced into autarkic policies as the result of the breakdown of interregional exchange. The period 1978 till now has been characterized by increasing resort to market relations, though still in the context of dominant state ownership of heavy industry and Communist Party control of economic policy. We can examine how the tendency towards convergence was affected by these alternative policy episodes.

A second reason for interest is that China displays vast geographical disparities in the sectoral distribution of economic activity, living standards, resource base, and other determinants of income levels and income growth. These disparities put the issue of convergence into very sharp relief, since the gap in per capita income between the richest and poorest regions in the 1950s was as great as 11 to 1.<sup>1</sup>

A third reason for interest is that China provides some important hints about the future tendencies that may face the second-most populous country in the world, India, as economic liberalization proceeds in that country. Indian policy-makers are worried that the trade liberalization initiated in 1991 might lead to widening inequalities among India's diverse regions. China's experience with trade liberalization after 1978, with rapid growth in the coastal provinces, should give some indication of the patterns that will be seen in India in future years.

The next section, section 2, reviews the findings from previous research on regional and

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In 1952, the poorest province was Guizhou, with a per capita GDP in 1952 yuan equal to 57.38. The richest province was Shanghai, with a per capita GDP in 1952 yuan equal to 640.20.

global convergence and asks whether similar results should apply in a planned economy such as China. Section 3 then presents the basic findings on Chinese economic convergence. We find that the tendency towards convergence has varied over time, according to the policy regime, with the strongest tendency towards convergence during the period of market reforms, 1978 till now. Sections 4, 5, and 6 then offer more detailed statistical analysis of each of the three main periods, in an attempt to understand the economic forces behind the basic convergence results. Section 7 then asks whether China is now on a path towards regional convergence or divergence. The last section offers some discussion and suggestions for future research.

## 2. Convergence Across Regions and Countries

Since there is no single accepted model of economic growth, there is no single theory of economic convergence. In the closed-economy Solow-Swan growth model, economies differ in per capita income as a result of differences in the capital-labor ( $K/L$ ) ratio. For a given savings rate, a lower initial  $K/L$  is associated with a faster proportionate increase in  $K/L$  on the path to equilibrium (Barro and Sala-I-Martin, 1995, Chapter 1). Hence, there is a tendency for poor countries to grow more rapidly than rich countries. If there is factor mobility between economies, labor will tend to migrate from the capital poor to the capital rich economy, while capital will tend to migrate in the other direction. Both types of migration will tend to equalize  $K/L$  between the economies, and thereby to equalize per capita income levels. Thus, factor mobility across regions will tend to speed the rate of convergence. Factor mobility may include flows of technology -- through licensing, foreign direct investment, joint ventures -- as well as flows of labor and capital.

Romer (1986) stressed that convergence need not occur if technology exhibits increasing returns to scale, rather than constant returns to scale as in the Solow-Swan model. In the case of increasing returns technology, national economies or regions that start with a high level of  $K/L$  tend to maintain their lead in income levels over economies that start with lower levels of  $K/L$ . In Romer's models,  $K$  refers not only to physical capital but to human capital and the endogenous accumulation of technology.

In even more general models, countries may differ in many dimensions other than resource endowments such as physical capital, human capital, labor, natural resources, and endogenous technology. Economies will differ in the stability and legal protection of property rights; the extent of government intervention in markets; and in other "endowments" not generally counted in the national accounts, such as geographical advantages or disadvantages. These differences may result in persistent differences in income levels across regions or national economies. Convergence among regions will be incomplete, even when the technology does not exhibit increasing returns to scale. Tendencies towards convergence may still exist -- countries with low  $K/L$  may grow faster than countries with high  $K/L$ , all other things constant -- but tendencies towards convergence would be evident only after controlling for the other determinants of long-term income levels.

There has been lively empirical research in the past decade examining whether nations or sub-national economies tend to converge in real living standards over long time periods. One of the most provocative early works, by Paul Romer (1986), stressed that there was no tendency towards convergence among all countries in the world in the post-war era. Romer suggested cautiously that the lack of convergence was evidence that aggregate production is subject to important increasing returns to scale.

Later studies have suggested that factors other than the returns to scale in aggregate production can better explain the presence or absence of convergence. Several studies of regions within nations have found strong evidence for convergence. We noted in the introduction that Barro and Sala-I-Martin found evidence for convergence within the states of the United States over the period 1880-1990; within Japanese prefectures over the period 1930-1990; and within sub-national regions in Western Europe over the period 1950-1990. In all three cases they find strong evidence for what they term "unconditional convergence," defined as a tendency for the dispersion of income across regions to narrow over time.

When we turn to the world economy, there is evidence of convergence within subsets of economies, even though there has not been convergence in the world economy as a whole. Dowrick and Nguyen (1989) have found evidence for convergence among the OECD economies, and Ben-David (1993) has found evidence for convergence among the countries of the European Community. More recently, Sachs and Warner (1995) argue that convergence is found in the subset of countries linked together by open trade policies. When Sachs and Warner divide the world into open and closed economies, they find that the open group displays convergence, while the closed group does not.

One unifying theme behind these empirical results, as well as the basic theory, is that convergence is most powerful when the economies in question are linked by open trade and factor mobility. The evidence suggests that inter-regional flows of labor, capital, and technology are the most important forces in the observed convergence of regions within a country, or between national economies linked through world markets. The conditions for a high degree of trade integration and factor mobility obviously apply within the regions of a single market economy, such as the states of the United States and the prefectures of Japan. They also apply, though somewhat less strongly, within the OECD, the European Union, and the subset of open-trading countries in the world system.

Many of the channels for convergence will tend to be cut off in socialist economies. The internal migration of labor is controlled by the government, usually for purposes of internal security as well as to meet bureaucratic targets for industrialization in particular regions. Similarly, investment spending across regions is allocated on the basis of political and bureaucratic considerations, not market returns. Moreover, technologies do not readily diffuse throughout the socialist economy. This was especially true in the Soviet Union, where research and development was concentrated in the military-industrial sector, with little diffusion to civilian industry.



Tendencies towards convergence in centrally planned economies would therefore tend to be somewhat accidental in character. Central planners might or might not allocate capital to the poorer regions, perhaps as a result of bureaucratic targets for income equalization across the country. However, given the strong lobbying pressures of state enterprises in the socialist system, it is more likely that bureaucratic allocations of physical capital will tend to flow to existing concentrations of state enterprises, rather than to new geographical areas.

Since labor migration across regions is normally such an important part of convergence within a market economy, it is worth describing the limitations on labor mobility within China. Since the 1950s, labor migration has been controlled by the central government, mainly to prevent peasants from migrating to urban areas. The core of the controls lies in the 1958 Regulation on the Registration of Households, which requires every household to register its place of residence, and to gain permission for any change in residence. Official permissions for changes in residence are strictly limited. During the period until the early 1980s, migration without permission (e.g. as an unregistered migrant working in an informal or non-state capacity) was extremely difficult. Food was strictly rationed, with food rations allocated on the basis of one's official residence. To move without permission would therefore mean to forego one's food rations, a near impossibility in the 1950s-1970s. In addition, children of illegal migrants would be denied access to schools, and other services provided in urban areas would similarly be unavailable to unregistered migrants.

With the adoption of market reforms starting in 1978, it has become possible to obtain food and lodging on a market basis, so that unregistered migration has become somewhat easier in recent years. Nonetheless, the constraints against unregistered migration from the countryside to the urban areas are still powerful, since illegal migrants generally lack access to schooling for children, state-run health care and other urban services. Nonetheless, informal migration has increased enormously in the 1980s and 1990s, to an estimated 100-150 million persons in the mid-1990s. Many of the migrants are single, without families. Others are migrants who leave their families in rural areas for temporary work in the urban areas and then return to the countryside, perhaps on a seasonal basis.

### 3. Evidence on Convergence among Chinese Provinces

When we turn to China, therefore, we should expect that tendencies towards convergence should depend on the balance between market and non-market forces. In particular, we would expect to see more forces working towards convergence after the onset of market reforms in 1978, and especially in the most market-oriented parts of the country. We therefore begin our study of Chinese convergence by dividing recent Chinese economic history into three sub-periods: the advent of state-led planning and the push for industrialization, 1952-1965; the Cultural Revolution, 1965-1978; and the period of market reforms, 1978-the present. This temporal division is justified on a priori grounds, since these periods reflect dramatic differences in basic economic policy.

The People's Republic of China is currently divided into 30 provinces. Our sample has 28 provinces for the reform period (1978-1993). The two remaining provinces (Tibet and Hainan) do not have data until in the late 1980's. In earlier periods, the sample size is smaller because of data availability, but we have data on a core group of 15 provinces for the entire 1952-1993 period. A map of these provinces is shown in Figure 1, together with the province names and codes in Table 1. In Table 2 we show some basic economic data for these provinces in the middle of our sample, 1978. Per capita income is measured as per capita GDP in units of 1952 yuan, using provincial retail price deflators for each province. Further details about the data are reported in the appendix.

We start with two ways of examining the presence or absence of unconditional convergence. The first measure is so-called  $\sigma$ -convergence. We measure the standard deviation across regions of the logarithm of real GDP per capita, LGDPPC. We say that there is  $\sigma$ -convergence if this standard deviation tends to decline over time. The second measure is so-called  $\beta$ -convergence. Here, we regress the proportionate growth in per-capita GDP on the initial level of per-capita GDP. We say that there is  $\beta$ -convergence if the coefficient on initial income, denoted  $\beta$ , is negative and statistically significant.

The evidence on  $\sigma$ -convergence is shown in Figure 2, where we plot the standard deviation of LGDPPC. We report the results for both a 15-province sample, which we have for selected years over the entire period, and for a 27-province sample which is available more frequently for the 1978-1993 period. The vertical lines demarcate the three main periods of policy, 1952-65, 1966-77, and 1978-93. We see from the figure that regional income dispersion fell slightly between 1952 and 1965, with a sharp rise associated with the Great Leap forward and natural disasters in the early 1960's, with a sharp reversal after 1962. The regional income dispersion then rose steadily and significantly during the Cultural Revolution. The 1978 reforms started a steady 12-year decline in regional income dispersion that seems to have ended around 1990. The last three years in the figure provide some evidence that regional income dispersion has widened since 1990.

These same basic timing is evident in the measures of  $\beta$ -convergence, shown in the regressions in Table 3. The table reports a small, and statistically insignificant negative association between growth and initial GDP per-capita during the 1952-1965 period. During the Cultural Revolution, by contrast, we see a positive and statistically significant value of  $\beta$ , evidence for divergence. During the reform period, there is statistically significant evidence of convergence.

The evidence at this broad level therefore suggests that regional income convergence is a relatively recent phenomena in China, emerging in a decisive way only since the reforms began in 1978, and perhaps ending (at least temporarily) in the early 1990s. In the following section we examine the three periods in more detail to understand what is driving these results.



#### 4. Episodes in Chinese Policy

##### (a) Central planning, 1952-1965

The first phase includes the first 5-year plan (1953-57), based on Soviet-style central planning; the Great Leap Forward, 1958-61; and a return to modified central planning during 1962-65. We find little evidence for convergent forces during this period. Instead, the dispersion of provincial GDP is better explained in terms of three sharp policy shifts as well as the natural disasters that hit the interior during the period 1959-1961.

The major thrust of the first 5-year plan was a push for Soviet-style industrialization and a bias against agricultural regions. Industrial investments went mainly to the provinces that already had some industry at the start of socialist period, specifically Shanghai, Liaoning, and Tianjin. Since agricultural provinces as of 1952 had lower than average incomes at the start of the period, and received a disproportionately small share of centrally allocated resources for industrialization, the push for industrialization should by itself have promoted divergence rather than convergence in provincial incomes. It is therefore unclear why the overall evidence suggests, if anything, a very slight convergence in provincial incomes.

To look at this further, we report convergence regressions in Table 4 that attempt to control for the anti-agricultural bias of the central planning system. For each province, we calculate the share of agriculture in GDP within the province in the initial year 1952, and include that agricultural share as a regressor. We presume that provinces with a high share of agriculture in 1952 will grow less rapidly during 1952-65, since these provinces will be discriminated against in the allocation of industrial investments. This indeed appears to be the case: the initial agricultural share of GDP share enters with a negative coefficient that is close to statistical significance. Controlling for the agricultural share, the initial per capita income now enters with a negative and statistically significant coefficient. Taken at face value, the regression suggests that there were two offsetting forces at work during 1952-65: a bias against the agricultural regions, which tended to promote divergence (since the agricultural regions were below average in per capita income), together with additional, and unidentified, forces pushing towards convergence. The overall result was a very slight amount of convergence.

When we divide the years 1952-65 into sub-periods, we replicate the same basic results for the first sub-period, 1952-57, but we find no tendencies towards convergence nor anti-agricultural bias during 1957-65. The economic disaster of the Great Leap Forward (1958-1960), the natural disasters of 1959-61, and the recovery under Liu Shaoqi (1962-65), created huge shocks to regional income but with little net effect on convergence. This is shown in evident in the third regression in Table 4, where neither the agricultural share nor initial income enter significantly.

##### (b) The Cultural Revolution, 1965-1978.

In the previous section we found clear evidence for unconditional divergence during the Cultural Revolution, as shown by a rising standard deviation in Figure 2, and by the positive coefficient on initial income in the regression of Table 3. Let us consider the major factors that might lie behind these results.

The Cultural Revolution was, of course, a seismic upheaval in social, political, and economic dimensions. In the economic domain we can mention five crucial components:

(1) central planning was thoroughly disrupted, as a result of Mao Zedong's purge of the central government bureaucracy;

(2) regions were forced into near autarky;

(3) agricultural production was politicized in the extreme, with economic incentives nearly fully replaced by bureaucratic controls;

(4) agricultural production was disrupted as provinces were forced to pursue self-sufficiency in grain production;

(5) heavy industrialization in the North East (Shanghai, Liaoning, and Tianjin) was continued.

In Figure 3, we plot the growth of each province between 1965 and 1978 against 1965 per capita GDP. One can see that the three industrial regions (Shanghai, Liaoning, and Tianjin) contribute to the overall trend towards divergence: the industrial regions are relatively rich and grow relatively rapidly. The agricultural regions stagnate. In Table 5 we show that once the agricultural share of the province is added to the regression of growth on initial income, the positive coefficient on initial income disappears. Hence, the cause of divergence is the anti-agricultural bias of the Cultural Revolution. When we separate the period into two sub-periods, we see from the regression results that the anti-agricultural bias was most severe in the early phase, 1965-70.

#### (c) Market reforms, 1978-1993.

We have seen that during the most recent period there has been a trend of real income convergence among the provinces, though this convergence process may have slowed or reversed in the 1990s. In this section we examine convergence during the post-1978 reform period.

There are five critical elements of China's market reforms after 1978:

(a) the shift of agricultural production from the commune system to the household responsibility system;



(b) the freedom of townships and villages to establish industrial enterprises outside of the central plan;

(c) the gradual opening of the Chinese economy, particularly after the mid-1980s, both for trade and for foreign investment;

(d) the increased migration of workers from rural areas to urban and coastal areas.

(e) gradual reduction of centralized controls on prices, inputs and outputs, and the rising share of production outside of the state enterprise sector.

It is important to understand the timing and significance of the various aspects of China's reforms. The first significant reforms were in the rural areas. Starting in 1978, and concluding by 1982, the commune system was completely dismantled, so that peasant households were once again able to operate on their own plot of land. The households were responsible for delivering a fixed quota of crops to the government, and were able to sell any production surplus above that quota in the free market. The household plot was leased from the government, typically 15 years. Peasants were allowed to choose crops to plant, and to do activities other than traditional agriculture. Equally important, rural villages and townships were given the right to start small-scale industrial, construction, commercial enterprises outside of the central plan. These township and village enterprises (TVEs) absorbed excess labor from agriculture. Thus, the TVEs were designed in part to absorb labor that would otherwise move to urban areas in search of work.

This liberalization had two main effects. The first was a one-time spurt in agricultural productivity, mainly between 1978 and 1985, as agricultural production rebounded after the disasters of the commune system. After 1985, the pace of agricultural productivity improvement slowed markedly, as if the one-shot gains to liberalization had been reaped. The second main effect was the astounding growth of the TVEs, which continues to fuel rural growth until now. Thus, the liberalization of non-agricultural, non-state production has had a persistent effect on raising the growth rates of formerly agricultural areas.

The second main reform was the gradual opening of the Chinese economy. Starting in the late 1970s, the currency was devalued and enterprises were given more freedom to engage in international trade, especially exporting. Starting in 1980, China established 4 Special Economic Zones (SEZs) in two provinces, Guangdong and Fujian. In the SEZs local governments had considerable latitude to grant special privileges to exporting firms such as the right to import their intermediate inputs without duty, as well as the right to retain some or all of the resulting foreign exchange earnings. Foreign investment was also encouraged. Later, in 1984-1985, 14 coastal cities in a further 8 provinces were granted similar rights to encourage trade and foreign investment. Import duties were cut, the exchange rate was further devalued with an aim to achieving convertibility on the current account, and the freedom of foreign investment was extended, though many restrictions remained as a part of the government's industrial promotion strategy.

Across the entire reform period 1978-1993, we would expect the following to be true. First, rural areas should exhibit faster growth throughout the reform period. Second, the coastal regions should experience rapid growth as a result of the liberalization of international trade and investment flows. This should be especially evident after 1985, by which time 10 provinces had significant open coastal cities or special economic zones, and trade and foreign investment began to flow into China at significant rates.

To test these ideas, we add two variables to the standard convergence regressions: the initial share of provincial GDP in agriculture at the start of the period (1978), and a dummy variable coded to take the value 1 if the province contains open coastal cities, and the value of 0 otherwise. Regressions for the period 1978-93 are reported in Table 6A. We see that indeed, agricultural regions and coastal regions tended to grow more rapidly than the others. Once we control for agricultural and coastal regions, however, there is no additional evidence for convergence: the coefficient on initial income is slightly negative but far from statistical significance.

When we divide the period into sub-periods as shown in Table 6B, we see that the coastal effect operates strongly only after 1985, and especially strongly after 1990. According to the regression results, being a coastal province is associated with 0.8 percentage points faster annual growth during 1978-85; 3.2 percentage points during 1985-93; and fully 7.4 percentage points during 1990-93. The regressions also indicate that provinces with a high initial share of GDP in agriculture also grew faster in all sub-periods. It is probably more accurate to describe this as a rural effect rather than an agricultural effect, since much of the growth is probably due to the relatively fast growth of light industry, construction and services in the form of township and village enterprises (TVEs) in agricultural provinces. Since TVEs have been one of the main sources of Chinese growth during the whole period, the agricultural regions have probably benefitted disproportionately in growth rates from THE development.

Strikingly, once we control for the structural variables, there is no evidence for conditional convergence. The coefficient on initial income is always small and statistically insignificant. There were, apparently, no further systematic tendencies for poorer provinces to grow more rapidly than richer provinces after we take into account the rural reforms and the opening of the coastal areas.

So far, our rural and coastal effects enter as separate effects; but there are reasons to think that open provinces with large rural areas should have grown faster than open provinces with smaller rural areas. First, the main source of surplus labor to be employed in growing industries was in rural areas. Second, although there has been considerable migration to urban areas, residence restrictions mean that migration from rural areas is still quite costly. Third, transportation costs mean that foreign investors prefer to invest in and trade with rural areas close to the coastal cities. Together, these three reasons lead us to expect an interaction between the coastal and rural effects.



We examine this in column 4 table 6B by adding a coastal-agricultural interaction term to the basic regressions. As we found before, during the first phase of reform, 1978-1985, little else is significant besides the agricultural share variable. Therefore, convergence occurred during the first phase of reform because rural areas started out below average in per-capita income and then benefitted disproportionately from the reforms and thus grew faster. During the second phase of the reform that also included trade liberalization, we see an additional effect. In the fourth column of table 6B we see that the coastal dummy variable is not significant but that the interaction term with the agricultural share variable is significant. The agricultural share variable is still significant. Therefore, convergence occurred during the second phase of reform because poorer rural areas continued to grow fast, but also because rural areas near open coastal cities grew especially fast. Thus the opening promoted convergence, but it did so by raising incomes of rural areas adjacent to open coastal cities.

We have seen that the overall effect of rapid agricultural and coastal growth was a narrowing of the dispersion of log incomes, and the regression evidence suggests that convergence was especially fast within the coastal regions. Now we examine the timing of the convergence across the 1978-1993 period more closely and divide China into coastal and interior regions. It turns out that almost all of the narrowing is due to a narrowing of income inequality among the coastal provinces, rather than a narrowing between the coasts and the interior provinces, or a narrowing of income inequalities among the interior provinces. This is evident in the variance decomposition shown in Table 7, where the overall variance of log incomes is decomposed into three components: within coast, within interior, and between coast and interior. We see a sharp narrowing of income inequalities among the coastal provinces, mainly as the agricultural South catches up with the industrial North. We see a slight narrowing among the interior provinces, but that narrowing basically ends by 1985. Finally, we see a relatively constant variance between the coast and interior between 1978 and 1990, but then a dramatic widening after 1990. We now turn to the implications of this widening inequality between the coastal provinces and the interior.

#### 7. On a path of divergence in the 1990s?

Even though China evidenced regional income convergence after the onset of market reforms in 1978, the trend has seemingly reversed itself in the last few years. Starting in the early 1990s, the standard deviation of log of per capita real GDP has increased. The rapid growth of the coastal regions is now widening the inequality between the relatively rich coastal provinces and relatively poor interior regions.

Until the 1990s, the rapid growth of the coastal provinces did not contribute to an overall divergence of regional incomes. During the 1980s, the fastest growing coastal provinces were in the South, which started the period with below-average levels of per capita income. Two things changed in the 1990s. First, the relatively rich coastal provinces in the North, especially Shanghai, began to grow more rapidly. Second, by the 1990s, the fast-growing Southern

provinces were no longer below average in income levels. Their continued rapid growth therefore began to contribute to overall divergence in the 1990s, rather than to convergence, as in the 1980s.

These patterns can be seen clearly in Figure 4, where we divide the provinces into three regions: North coastal, South Coastal, and Interior.<sup>2</sup> Clearly the North coastal provinces (including the industrial provinces of Shanghai, Tianjin, and Liaoning) are the richest. The South coastal regions (including Guangdong, Fujian, Zhejiang) are next, followed by the Interior provinces. Figure 4 graphs the log of per capita income over the post reform period by the above three regions where per capita GDP is calculated by summing the total GDP within each region and divided by total population of the region. As we can see South Coastal provinces have faster growth throughout the period. Since they started out with below-average per capita income, their rapid growth initially reduced the overall dispersion of regional income. In the 1990s, the North coastal regions accelerated, and the South coastal regions were far above the national average in per capita GDP.

What will happen to the overall dispersion of Chinese regional income if the growth trends of recent years are maintained until the year 2000? To find out, we extrapolate recent growth rates forward from 1993 to 2000, and measure the standard deviation of log incomes as of the year 2000. The results are shown in Table 8. To make the extrapolations, we use four simple models:

- (1) simple extrapolation, using 1990-93 growth rates of each province;
- (2) simple extrapolation, using 1985-93 growth rates of each province;
- (3) regression of growth rate on initial income, coastal dummy variable, and agricultural share of GDP, estimated for 1990-93;
- (4) same regression as in (3), estimated for 1985-93.

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The classifications are as follows. North coastal: Shanghai, Tianjin, Jiangsu, Shandong, Hebei, Liaoning; South coastal: Zhejiang, Fujian, Guangdong, Guangxi, Hainan (not in our sample); Interior: Inner Mongolia, Shanxi, Henan, Hubei, Hunan, Jiangxi, Anhui, Beijing, Shaanxi, Ningxia, Gansu, Sichuan, Yunnan, Guizhou, Qinghai, Tibet (not in our sample), Xinjiang.



When we project growth on the basis of the most recent years (1990-93), as in models (1) and (3), we project the largest increase in dispersion. This is because the coastal regions have been growing especially fast in the 1990s. When we project on the basis of 1985-93, as in models (2) and (4), the increase in dispersion is still large, but not as dramatic. The range of projected income dispersion is a value of  $\sigma$  between 0.56 and 0.86, compared with  $\sigma = 0.525$  in 1993. If the coastal regions continue to outpace the interior as they have done during 1990-93, then the overall amount of regional income dispersion will revert to levels of 1978, before the start of market reforms. It appears to us likely, however, the regional income inequality will widen rather than narrow in the years ahead.

There are forces at work that could conceivably strengthen the trends towards convergence. As market forces become more important within China, the migration of factors across regions will also become important. Labor will migrate from the interior to the coasts, and capital will migrate from the coasts to the interior. In recent years, labor migration seems to be of increasing importance. It is now estimated that some 100-150 million people have informally migrated to jobs in urban and especially coastal areas. Most of this "floating population" is unregistered. For this reason, we may even be overestimating the amount of divergence in income in recent years, by underestimating the population of the coastal regions and overestimating the population of the interior regions. Even less is known about interregional capital flows than is known about interregional labor flows. Anecdotal evidence suggests, however, that capital, like labor, has flowed from the interior to the coasts. In this case, capital has contributed to the forces of divergence, at least until now.

## 8. Conclusions.

We have found that real income convergence of Chinese provinces has been a relatively recent phenomena, emerging strongly only since the reform period began in 1978. For earlier periods, the evidence is not nearly as strong. During the initial phase of central planning, 1952-1965, there is some evidence for convergence, but it is weak and sensitive to the time period being analyzed. During the cultural revolution, 1965-1978, there is strong evidence of divergence rather than convergence.

We find that regional convergence is strongly associated with the extent of marketization and openness. Our strongest evidence for convergence is during the reform period. We find that convergence is associated with rural reforms, and is especially strong within the coastal regions where there has been liberalization of international trade and investment flows.

Our explanation for this is that many of the channels of convergence, such as labor migration, capital flows and technological diffusion, were simply cut off under central planning.

While it may be possible through bureaucratic allocation of resources to promote regional income equality, the evidence is that Chinese central planning had, if anything, the opposite effect.

Since 1990 however, regional incomes have begun to diverge. Our evidence is that this is entirely explained by an increase in the variance between the coastal provinces and the interior provinces, rather than from an increase in the variance within either the coast or the interior. Since being a coastal province is a geographic advantage that will persist, this tendency for divergence will also probably continue. Therefore, given current policies, it seems that China is now on a dual track, with a prosperous and fast growing coastal region and a poor interior growing at a lower rate..

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## List of Tables and Figures

### Tables

1. List of provinces
2. Basic Statistics, 1978
3. Basic Convergence Regressions
4. 1952-65 Regressions
5. 1965-77 Regressions
6. 1978-93 Regressions
7. Variance Decomposition: Coast and Interior
8. Projections of Regional Income Dispersion in the Year 2000

### Figures

1. Map
2. Standard Deviation of Log Per Capita Real GDP, 1952-93
3. Growth Rates Versus Initial Income, 1965-78
4. Log of Per Capita Real GDP by 3 regions: North, South, Interior

## APPENDIX: DATA DESCRIPTION

This appendix describes data sources, methods in generating the data, and explains variables used.

### Sources of Data

Our data cover forty two year period (1952-1993) and 28 provinces in China. The two exclusions are Hainan, newly established province and Tibet which does not have data until 1987. All the data are compiled from Chinese official statistics publications. They are A) China Statistics Yearbook 1991, 1992, 1993, and 1994; B) various volumes of 28 provincial statistics yearbooks; C) China's Historical Statistics 1949-1989; D) China Price Statistics Yearbook 1988-1992.

Because of the length of period covered and the number of variables involved, no single source is complete for the data we require. To make things more difficult is that each data source has its own drawbacks. For instance, Source A provides data for all provinces, but with fewer years and fewer decimal points, and data are not updated. Source B usually provides more detailed and longer time span data, but could differ from province to province in terms of years listed, or else, so direct comparison across provinces cannot be realized. Source C is a good complementary to Sources A and B, but not a substitute. It is aimed to build up a historical data by province such that data on each province contain the same variables and calculated in the same fashion. However, data in Source C tend to not be accurate for years in the late 1980s. Source D again provides a complementary to Source B for provincial retail price index.

### Approaches in Generating the Data

Because of the nature of our data sources, we set up the following criteria to generate a consistent data base for the study. 1) Use the most possible recent data; 2) For years between 1952 and 1989, use data from China's Historical Statistics 1949-1989 as much as possible and confirmed with other sources for data in the late 1980s; 3) Use provincial data as much as possible and confirmed with other sources; 4) Use data with more decimal points; 5) Whenever possible, enter all the data from sectors and sum them up to generate the total, and compare this total with the figure from the source. If the summed total differs from the printed total, then check other sources. In this way, we corrected many printing, rounding off errors, calculation errors from the origin. We believe that this compiled data are more reliable than data from any single source listed above.

### Definition and Explanation of Relevant Data

## GDP

Gross Domestic Product (GDP) and Gross National Product are defined in the same way as in the west. However, for most provinces we can find only GDP or GNP in China's statistics. And if both are provided, there the same for almost the entire period covered. In the rare circumstances in which GDP and GNP differ, the difference is very, very small, and will not affect statistics analysis results by misusing one for another, at least until 1993. Therefore, in cases where GDP is not available, its GNP is used instead. For years between 1952 and 1977 there are only 15 provinces with GDP data, whereas after 1978 most provinces have GDP data.

China's GDP is classified into three broad sectors: primary sector, secondary sector, and tertiary sector. Primary sector includes agriculture, forestry, husbandry, fishing and water supply. Secondary sector comprises of industry and construction. Tertiary sector includes mining, geographic survey and prospecting, transportation, commerce, public food and drinking services, material supply and purchases, material stocking, public utilities, science and research, education, governments and social organizations, culture, sports, social welfare, etc. We use primary sector share of GDP to measure the change in economic structure and its effect on growth. Note in the text, primary sector is loosely referred as agriculture sector.

## Population

Total population refers to the total number of human beings at the end of a certain year in the region concerned. We use total population in combination of GDP and deflated by provincial retail price index to generate per capita real GDP by province.

## Price Indexes

- 1) Provincial retail price index: this is compiled by each province independently. We cannot find explanations on the number of products and the way how it is compiled, and we do not know if each province compiles it in the same manner. Data on provincial retail price index is available for years starting 1952 for about three quarters of the provinces for selected years. For years after 1978, the data are available for nine tenths of the provinces.
- 2) Retail price index by province compiled by China's Statistics Bureau: it is compiled by using the same product list to compile such an index. The problem is that the data is available only after 1978 and it is available only in China Statistics Yearbook. As we mentioned that China Statistics Yearbook does not update the data for previous publications, so data may not be as accurate. Indeed when we compare it with provincial retail price index we found it reports lower retail prices for some of the provinces in years between 1978 and 1985. But the difference is only for a few provinces and our results would not change because of using either source.
- 3) In our analysis, we use provincial retail price index for years between 1952 and 1978, and retail price index compiled by China Statistics Bureau for years 1978 and 1993.

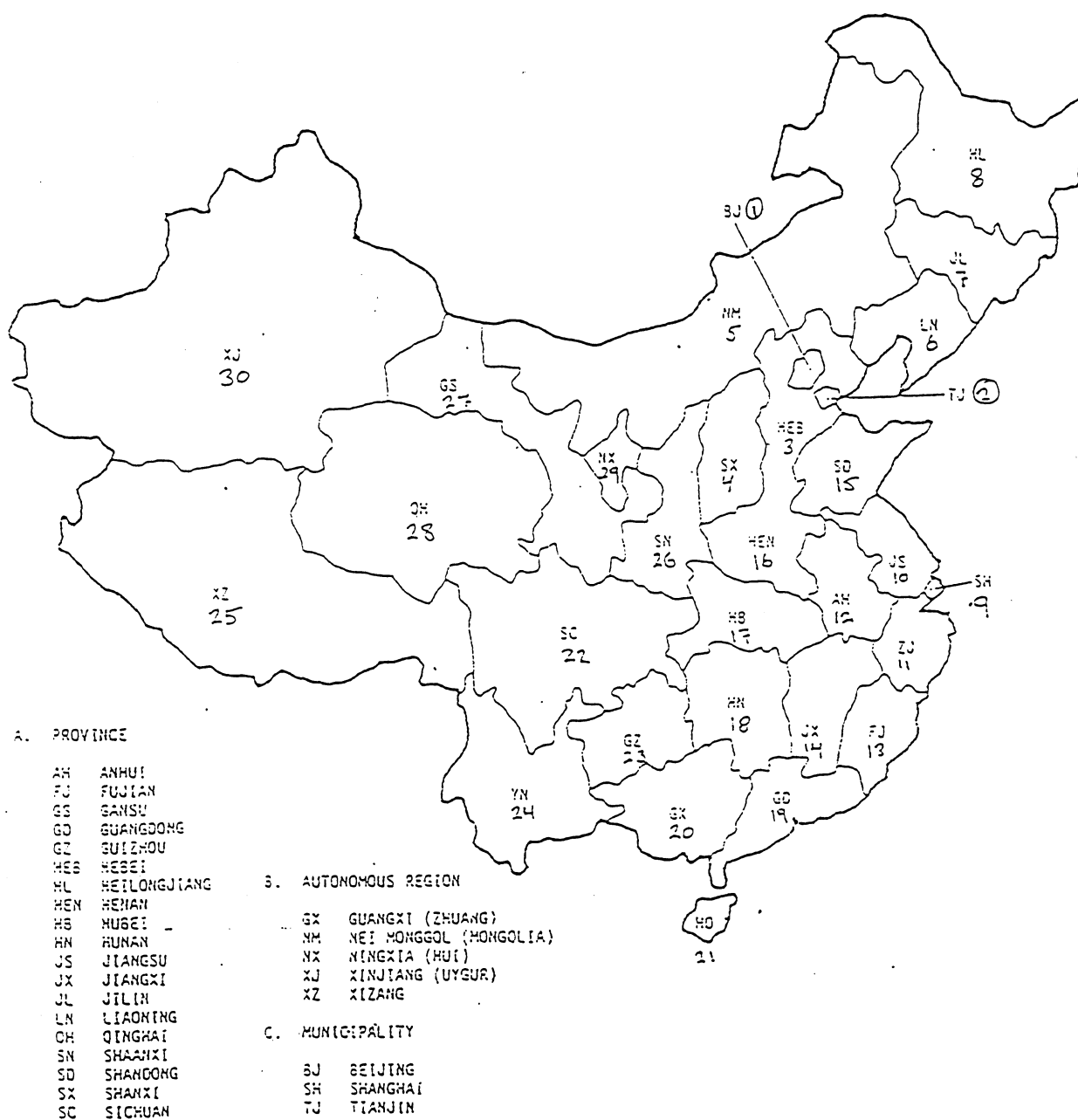


Figure 1: Administrative Division of China



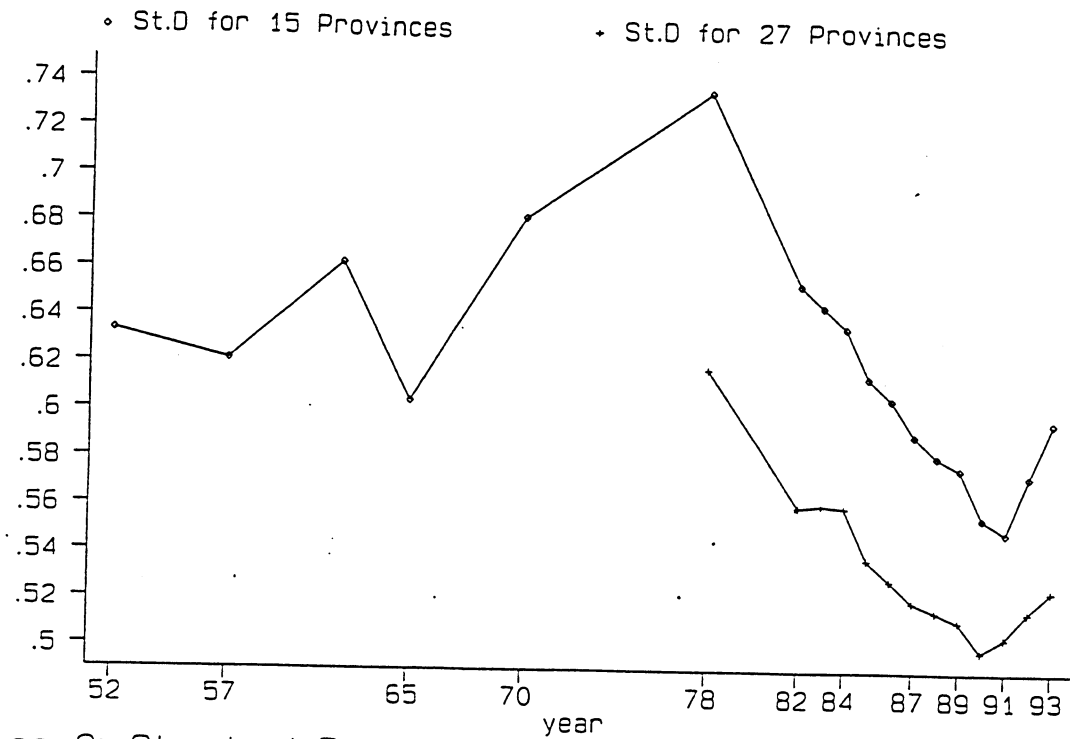


Figure 2: Standard Deviation of Log Real Per Capita GDP

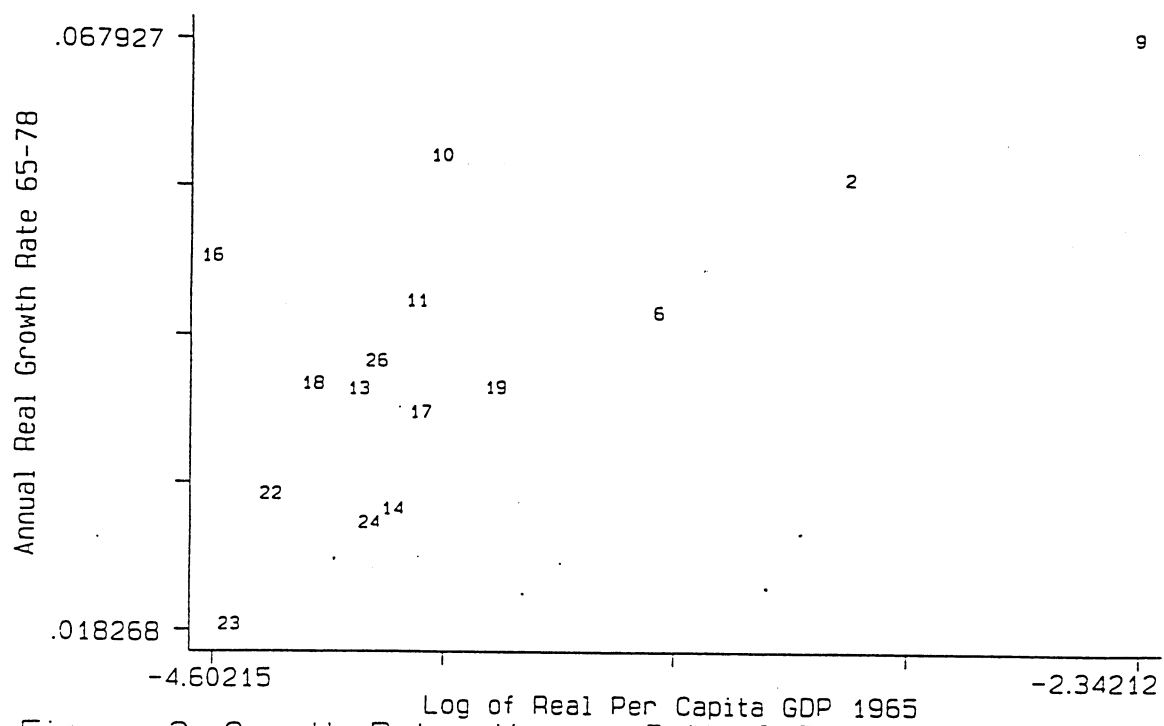


Figure 3: Growth Rates Versus Initial Income, 1965-1978

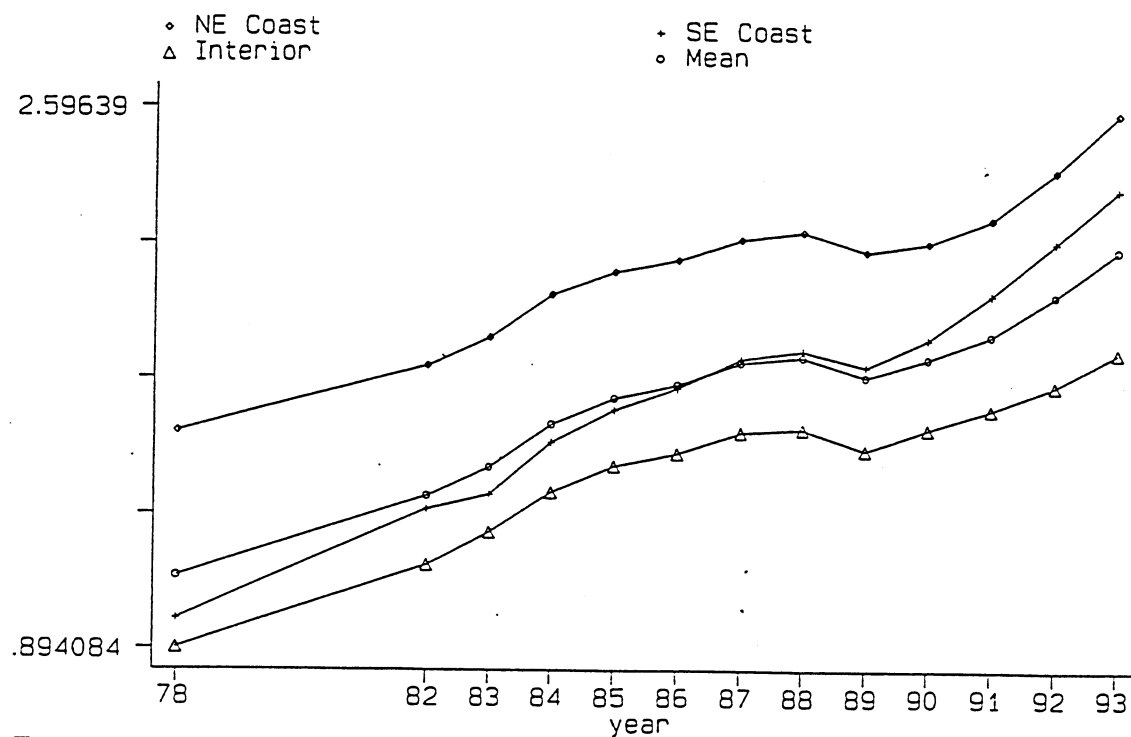


Figure 4: Log of Real Per Capita GDP by Region, 78-93

Table 1: List of Provinces

Code	Province
1	Beijing
2	Tianjin
3	Hebei
4	Shanxi
5	Inner Mongolia
6	Liaoning
7	Jilin
8	Heilongjiang
9	Shanghai
10	Jiangsu
11	Zhejiang
12	Anhui
13	Fujian
14	Jiangxi
15	Shandong
16	Henan
17	Hubei
18	Hunan
19	Guangdong
20	Guangxi
21	Hainan
22	Sichuan
23	Guizhou
24	Yunnan
25	Tibet
26	Shaanxi
27	Gansu
28	Qinghai
29	Ningxia
30	Xinjiang



Table 2: Basic Statistics, 1978.

Name	Population ( 10,000)	GDP Per Capita at 1952 prices (yuan)	Agriculture Share of GDP	Coastal Dummy
Beijing	849.70	1093.28	0.05	0
Tianjin	724.00	985.39	0.06	1
Hebei	5057.00	367.88	0.29	1
Shanxi	2423.60	308.46	0.21	0
Inner Mongolia	1823.00	260.16	0.34	0
Liaoning	3394.00	535.09	0.15	1
Jilin	2149.30	286.01	0.29	0
Heilongjiang	3129.60	430.84	0.24	0
Shanghai	1098.28	2324.51	0.04	1
Jiangsu	5834.00	372.37	0.28	1
Zhejiang	3751.00	299.57	0.38	1
Anhui	4713.00	201.22	0.48	0
Fujian	2452.80	235.75	0.36	1
Jiangxi	3183.00	225.20	0.42	0
Shandong	7160.00	297.93	0.33	1
Henan	7067.00	189.99	0.40	0
Hubei	4574.91	268.08	0.40	0
Hunan	5165.91	212.09	0.41	0
Guangdong	5064.15	330.99	0.30	1
Guangxi	3402.00	163.99	0.41	1
Hainan	528.00	.	.	.
Sichuan	9708.00	169.92	0.39	0
Guizhou	2686.00	133.22	0.42	0
Yunnan	3091.00	209.28	0.43	0
Tibet	179.00	.	.	.
Shaanxi	2780.00	253.98	0.30	0
Gansu	1870.00	304.71	0.20	0
Qinghai	365.00	550.92	0.24	0
Ningxia	356.00	284.56	0.18	0
Xinjiang	1233.00	335.47	0.36	0

Table 3: Basic Convergence Regressions.

	1952-65	1965-78	1978-93
Constant	0.008 (0.302)	0.103 (6.137)	-0.004 (0.237)
Log of Initial Per Capita Real GDP	-0.006 (-1.126)	0.016 (3.735)	-0.017 (-3.320)
Observations	15	15	28
R-squared	0.088	0.518	0.298

Table 4: 1952-1965 Regressions

Dependent variable: Annual growth rate of real per capita GDP.

	Log Initial Per Capita Real GDP	Initial Agriculture Share	Constant	Adj. R-squared	Observations
52-65	-0.029 (-2.103)	-0.079 (-1.779)	-0.054 (-1.295)	0.159	15
52-57	-0.062 (-1.973)	-0.180 (-1.809)	-0.114 (-1.208)	0.119	15
57-65	-0.001 (-0.056)	0.012 (0.317)	0.007 (0.227)	-0.053	15

Table 5: 1965-1977 Regressions.

Dependent variable: Annual growth rate of real per capita GDP.

	Log Initial Per Capita Real GDP	Initial Agriculture Share	Constant	Adj. R-squared	Observations
65-78	-0.005 (-0.467)	-0.078 (-2.105)	0.055 (2.017)	0.589	15
65-70	-0.026 (-1.208)	-0.187 (-2.467)	0.006 (0.102)	0.491	15
70-78	0.011 (0.699)	0.007 (0.113)	0.087 (2.506)	0.127	15



Table 6A: 1978-1993 Regressions.

Dependent variable: Annual growth rate of real per capita GDP

<u>Period</u>	Log Initial Per Capita Real GDP	Initial Agriculture Share	Coast	Adj. R-squared	Observations
78-93	-0.017 (-3.320)	-----	-----	0.271	28
	-0.001 (-0.086)	0.097 (1.828)	-----	0.331	28
	-0.009 (-1.105)	0.080 (1.883)	0.021 (3.933)	0.576	28

Table 6B: 1978-1993 Regressions.

Dependent variable: Annual growth rate of real per capita GDP.

Observations: 28

Period	Log Initial Per Capita Real GDP	Initial Agriculture Share	Coast	Coast Interacted with Agriculture Share of GDP	Adj. R-squared
78-85	-0.023 (-3.788)	----	----	----	0.271
	-0.003 (-0.246)	0.116 (1.931)	----	----	0.394
	-0.006 (-0.507)	0.110 (1.818)	0.008 (1.054)	----	0.397
	-0.002 (-0.170)	0.107 (1.745)	-0.006 (-0.273)	0.047 (0.697)	0.384
85-93	-0.010 (-1.348)	----	----	----	0.029
	0.017 (1.243)	0.156 (2.314)	----	----	0.169
	0.002 (0.185)	0.130 (2.820)	0.032 (5.448)	----	0.613
	0.007 (0.744)	0.974 (2.179)	-0.001 (-0.070)	0.108 (2.338)	0.674
90-93	0.005 (0.334)	----	----	----	-0.034
	0.040 (1.319)	0.190 (1.343)	----	----	-0.003
	0.012 (0.714)	0.206 (2.584)	0.074 (7.423)	----	0.683

Table 7: Variance Decomposition: Coast and Interior

year	Total Variance	Variance within the Coast	Variance within the Interior	Variance between the Coast & Interior
78	0.3819	0.5837	0.2088	0.0514
82	0.3136	0.4290	0.1806	0.0539
83	0.3147	0.4330	0.1945	0.0452
84	0.3136	0.4277	0.1901	0.0486
85	0.2894	0.3982	0.1681	0.0482
86	0.2798	0.3733	0.1648	0.0492
87	0.2704	0.3481	0.1608	0.0509
88	0.2663	0.3306	0.1648	0.0504
89	0.2621	0.3136	0.1656	0.0517
90	0.2490	0.2927	0.1608	0.0487
91	0.2550	0.2663	0.1689	0.0589
92	0.2663	0.2470	0.1706	0.0758
93	0.2756	0.2372	0.1552	0.0980

Note: The variance decomposition is from the formula:

$$\text{Var}(X) = a * \text{Var}(X1) + b * \text{Var}(X2) + c * (\text{Mean}(X1) - \text{Mean}(X2))^2$$

Where X1 refers to the coastal regions and X2 refers to the interior. The last three columns in the table correspond to  $\text{Var}(X1)$ ,  $\text{Var}(X2)$ , and  $c * (\text{Mean}(X1) - \text{Mean}(X2))^2$ . The constants a, b, and c, are weights that depend on the number of provinces in each of the two regions.

Table 8: Projections of Regional Income Dispersion in the Year 2000

<u>Year</u>	<u>Standard Deviation Of Log Income</u>	<u>Observations</u>
1993	0.525	27

Projections for 2000

1) based on actual 90-93 growth rates	0.675	27
2) based on actual 85-93 growth rates	0.560	27
3) based on regression of growth rates on initial income, coastal dummy, and agricultural share of GDP, estimated for 90-93	0.860	27
4) based on regression of growth rates on initial income, coastal dummy, and agricultural share of GDP, estimated for 85-93	0.662	27

