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The Coastal-Inland Income Gap in China during the 1990s: The Role of Geography and Policy

Abstract

We investigate the enlarging coastal-inland income gap in China during the 1990s, using GMM estimation of a Solow growth model. Disaggregating capital investment by source: public, foreign and private: helps to disentangle the effect of policy from those of geography. The impact of public investment on growth is insignificant in our panel data for 29 provinces; that of foreign investment is significant; private investment is most influential. We also use the distance by railway of each province's capital city to its nearest port city as a proxy for transportation costs, and find significant differences across regions. Distance has negative effects on economic development but its marginal impact effects become less as distance increases. The coastal-inland gap will grow in the foreseeable future, if inland areas are not able to benefit from an increase in private investment and infrastructure improvements (to reduce transport costs).

Key words: China, Growth, Geography, Coast, Inland, Inequality and Policy.

JEL classifications: O11, O15, O18, O20, O47, O53, P21, R11 and R12

I. Introduction

China receives attentions from the world for obvious reasons. It is a transitional economy, turning from plan to market system; it is a country with the largest population and the third largest area in the world. The 9.6 million kilometer-squared land is divided into 31 administrative regions at provincial level, which are comprised of 5 autonomous regions, 4 metropolitan cities and 22 provinces. However, the regions are very different from each other in terms of geographical locations, natural conditions, cultural features and educational levels, among others. Therefore, the heterogeneity in the regional development process during the reform period attracts the attention of economists in many aspects. In this paper, regional inequality between coastal and inland areas in economic growth is our subject.

After the inception of economic reform, both coastal and inland areas in China developed very rapidly. However, the most distinguishable feature of regional development in China is the increasing gap between coastal and inland areas in terms of economic performance. Many facts show that a typical inland area lags far behind as a typical coastal area gets more and more prosperous. Is this due to the geographical location difference?

The relationship between geographical location and economic development has been investigated by many researchers. Typically, controlling for economic policies and institutions, Gallup, Sachs and Mellinger (1998) study the possible channels through which geographical effects can influence economic growth and policy choices. Their finding shows that geography has large influence on economic development via channels such as transportation costs, agricultural productivity, and natural resource endowments among others. Geography itself is a factor in the choice of economic policy. On the other hand, Krugman (1998) employs the tension between 'centripetal' and 'centrifugal' forces acting on economic activity to study this problem. He concluded that different responses to these forces could make relatively similar locations end up with quite different market powers. The above two approaches are compared by Gallup, Sachs and Mellinger (1998), in which they conclude that Krugman's model shows "*how increasing returns to scale, agglomeration economies, transportation costs and product differentiation can lead to a highly differentiated spatial organization of economic activity, even when the underlying physical geography is undifferentiated.*" In particular, the role of 'self-enforcing' in spatial patterns is emphasized in his model. However, the starting point in the model of Gallup, Sachs and Mellinger is that, "*the physical geography is in fact highly differentiated*", which has the advantage of matching well for the case of coast-inland studies.

The problem of the enlarging income gap between coastal and inland areas in China has been studied extensively; our summary is not exhaustive. Jian, Sachs and Warner (1996) attribute the convergence phenomenon during 1980s to the catching up of the initially poorer southern coastal provinces to the initially richer northern coastal provinces. Kanbur and Zhang (1999) compare the urban-rural and the coastal-inland income gap in China during the 1980s and 1990s. They draw the conclusion that the former has not changed much over time, while the latter has increased several fold and thus becomes the dominant source of income inequality in China after 1990. Fleisher and Chen (1997) consider that the lower factor productivity of inland areas compared with coastal areas contributes to the persistent income gap between them, while investment in higher education and the concentration of foreign direct investment (FDI) helps to explain the productivity gap. In another paper, using provincial data for China from 1978 to 1993, Chen and Fleisher (1996) conclude that the income gap between coastal and inland areas is likely to increase in the near future and to focus solely on investment by rural collectives is insufficient to narrow the gap. In Demurger (2001), it is found that geographical locations and infrastructure endowment account significantly for the observed differences in growth performance across China's provinces. Wang and Hu (1999) argue that preferential policies generate higher growth for coastal provinces; at the same time, they also admit that their policy variable does not distinguish geographical locations, which may produce erroneous results. More recently, to explain the causes of the coastal and inland income gap, Demurger et al (2001) employ a model that disentangles policy factors and geographical factors in coastal areas' economic growth and a set of preferential policy indices has been used to capture policy effects on growth. Their conclusion, opposite to the argument by Wang and Hu (1999), is that the absence of favored polices in the coastal areas would not affect the economic growth rates of both the coastal and inland areas.

It is noted that both of the last two papers consider policy effects, yet different methods are employed for the analysis and different results have been obtained. In fact, the advantages of coastal areas relative to inland areas in China arise not only from their easier access to and cheaper transportation costs when accessing both international and domestic markets, but also from more favored conditions granted by "open door" policies. This suggests that policy should play an important role in the economic development process. Therefore, in this paper, apart from geographical factors, the policy factor is also taken into consideration, and we attempt to disentangle the influences of these two factors. In particular, the policy influence has been picked up by geographical distribution of capital investment in different ownership structures; while the geographical influence has been picked up by railway distance from each province's capital city to its nearest port city. These two methods are explained in detail as follows.

Firstly, it has been shown in Wang (2003) that capital investment has a positive and significant effect on regional economic growth. Thus, the more investment in physical capital a region receives, the higher economic growth rate it will achieve. However, the different performance of different ownership structures might not be captured by this aggregated capital investment, which is represented by total investment in fixed assets. Therefore, in order to capture the different effects exhibited by different ownerships on economic growth, we disaggregate capital investment in accordance with its ownership structure. The decomposition relaxes the underlying assumption that different ownership structures of capital investment affect economic growth to the same degree. Thus we will investigate the different impacts of the components of capital investment, on regional economic growth; foreign, domestic private and public investments are the components we consider. Furthermore, the geographical distribution of disaggregated capital investments has been affected by government policies to a large extent. In particular, the open door policy has granted coastal areas more favored conditions than inland provinces to attract foreign investment; this has led to the concentration of foreign investment in the coastal areas. On the other hand, public investment has been decided and allocated by both the central and local governments, therefore it is more evenly distributed between the coastal and inland areas. Thus, distinguishing public investment from other investment removes some of the overlap between policy and geographical effects.

Secondly, railway is the major transportation means within China. We assume transportation costs for a province can be proxied by the distance (by railway) between the provincial capital and its nearest port city. Such a distance can be used to model part of the cost of investment goods.

Therefore the objectives of this paper are to investigate the persistence and widening of the gap between coastal and inland areas by disentangling policy effects from geographical factors, which are captured by capital investment distribution and railway distance, respectively. In particular, we hope to uncover their roles in shaping the patterns of the coastal-inland gap in the 1990s. The structure of this paper is as follows. First, the coastal-inland gap in the 1990s is described in section-II. Secondly, the geographical distribution of disaggregated capital investments is illustrated in section-III, to give a better understanding of the different performances by different capital investment across regions. Thirdly, in section-IV, we introduce our model and present an empirical analysis of disaggregated capital investments by taking account of geographical factors. The results show that differences in ownership exhibit different influences on economic growth, while distance displays negative effects on economic growth, but at a decreasing rate as distance increases. The roles of public, foreign and domestic private investment will be discussed in detail in this section. And finally, the conclusion is given in section-V.

II. The Coastal-Inland Income Gap during the 1990s

There are 12 regions along the East Coast of China, including three metropolitan cities: Shanghai, Beijing and Tianjin; and nine provinces: Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi and Hainan. Among the other 19, inland, regions, 9 are located in the middle part of China, which covers Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan; while the other 10 regions belong to the western part; these are Chongqing (the fourth metropolitan city), Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang and Tibet. As in Wang (2003), it is noted that Tibet is excluded from our analysis for lack of data; while Chongqing is included in Sichuan Province, since its identity has been changed from an ordinary city to a metropolitan city only after 1997. In sum, we are going to deal with 29 regions, for which 12 belong to the coastal areas and 17 belong to the inland areas; the latter comprises 9 from the middle and 8 from the western part.

The coast-inland income gap today may be divided into two components: the initial income gap and the growth rates of different areas. Therefore, to show the initial income gap, the per capita real GDP of each region in 1991 is depicted in figure 1 by the regional geographical location. Obvious regional disparities can then be observed from the figure as per capita GDP level decreases from east coast to west inland. On the other hand, when looking at the growth rates, which are calculated as the averages of the differences in (natural) logarithm of per capita GDP between the initial and final years, figure 2 shows that most provinces in coastal areas grow faster than provinces in inland areas. For example, three coastal provinces: Fujian, Jiangsu and Zhejiang, whose per capita GDP grows at 14.44%, 13.64% and 13.28% per year respectively, exhibit the fastest growth rates in the 1990s. All eight western provinces grow at the slowest rate. The only inland province that grows as quickly as the top five fastest areas in China is Anhui province, which is located in the middle part of China. It is also noted that Liaoning province displays the slowest growth rate within coastal areas. As the northeast industrial center and the base for state owned enterprises (SOEs), such a disappointing performance indicates the plight of SOEs, and this will be further explained below. These two figures well exhibit the coast-inland income gap in the 1990s. In summary, coastal regions grow at faster rates, which further enlarge the coastal-inland income gap when combined with higher initial income levels.

[Figure 1 and 2 here]

Furthermore, the above regional inequality can be examined more accurately by employing the concept of sigma convergence. Jian *et al* (1996) apply this concept to investigate the tendency towards convergence among China's provinces from 1952-1993. Their results show that evidence for sigma *convergence* is weak during the period 1952-1965 and strong between 1978-1990, while strong evidence of sigma *divergence* can be seen during both 1965-1977 and 1990-1993. The divergence from 1990-1993, as they claimed, is entirely caused by the enlarged variance *between* coastal and inland areas, not *within* each area. Therefore, they concluded that regions within coastal areas display sigma convergence, while the coastal-inland gap keeps increasing. Following this method, sigma convergence is also analyzed in this paper by using regional data in China from 1993-1999, which is illustrated in figure 3. The standard deviations of regional logarithm of per capita real GDP from 1993-1999 within coastal areas, inland areas, between coastal and inland and the aggregated areas are represented by *sigma-coast*, *sigma-inland*, *sigma-between* and *sigma-aggregated*, respectively. They are related as follows. The total sum of squared deviations (of log per capita GDP) can be decomposed into the sum of squares within areas (coastal and inland) plus the sum of squares between areas. Each sum of squares (coastal, inland, between) yields standard deviation. Firstly, figure 3 shows that there is no strong evidence of sigma convergence within either coastal or inland areas, and the flatness of both lines indicates catching-up within neither. Secondly, it can be observed that the largest component of *sigma-aggregated* is *sigma-coast*, while all three sigmas have a similar slight upward trend from 1995 onwards.

A variance decomposition table for this figure is displayed in table 1, which provides the exact values for the four curves.

[Figure 3 and table 1 here]

In general, a conclusion can be drawn from the above observations: the enlarged gap between coastal and inland areas leads to the aggregated divergence during the 1990s. At the same time, no sigma convergence within coastal or inland areas is to be observed.

III. Geographical Distribution of Disaggregated Capital Investments

The issue of ownership indeed attracts special attention in the literature addressing economic growth in China. Berthelemy and Demurger (2000) regard the transfer of foreign technology as the key factor determining economic growth. Yet they also suggest that economic growth might simultaneously influence the inflows of foreign capital. Chen, Chang and Zhang (1995) find that FDI, lagged one year, has a positive effect on economic growth. Dees (1998) supports the view that FDI affects China's economic growth through the diffusion of ideas; while Wei (1996) concludes that FDI has a weak positive effect on economic growth. On the other hand, in a project supported by the Asian Development Bank, Mao and Zhang (2001) look into the relationship between the employment share of private enterprises and per capita GDP using 30 regions' data in 1999 for China. They conclude that private sector development is very much associated with regional income level and promotes regional economic growth. The latter conclusion has also been drawn by both Chen and Feng (2000) and Qian, Weingast and Cao (1997). However, it is pointed out that public investment has not been efficiently allocated or allocated to produce at a profitable scale, by some researchers such as Chen and Feng (2000); they find the presence of SOEs reduces the regional growth rate.

The decomposition of capital investment is shown in table 2. Total investment in fixed assets is disaggregated into public, foreign and domestic private investment. Public investment includes investments in fixed assets by SOEs and Collective-Owned Enterprises (COEs). Foreign investment refers to investments in fixed assets by Foreign-Owned Enterprises (FOEs) and Overseas Chinese-Funded Enterprises (OCEs). Domestic private investment refers to all private investments without foreign ownership.

[Table 2 here]

When examining the distribution of disaggregated capital investments in China, it has been pointed out that the most noticeable feature is the concentration of foreign investment in coastal areas: thus OECD (2000), *"From 1983 to 1998, FDI in the eastern region took up 87.8 percent while the central region attracted 8.9 percent and the western region recorded only 3.3 percent."* However, the distribution of public and domestic private investment is not given explicitly. In order to investigate this problem, table 3 lists simple averages of the ratios of the capital investment in fixed assets to GDP across the 1990s, for coastal and inland areas. From this table, firstly we see that all kinds of investments have higher ratios in coastal areas except investment made by SOEs. In fact, the exception can be ascribed to a political reason: SOEs are allocated by the central and local governments. Before economic reform, inland areas were more favored for the establishment of SOEs since they are further away from the outside world, thus reducing the risks induced by any possible conflicts between China and other countries. However, locating SOEs in inland areas turned out to be a disadvantage when trying to attract private investments (both foreign and domestic) after China adopted the open door policy. There is such a slow development of private investment in the inland areas that public investment, especially investment from SOEs, continues to be the major contributor of capital investment.

[Table 3 here]

Secondly, besides influencing SOEs' investment distribution patterns, government policy has also affected the foreign investment distribution pattern to a large extent. As shown in table 3, coastal areas receive relative to GDP almost 4 times the foreign investment that inland areas receive. The argument that the open door policy plays an important role in determining the geographical distribution of foreign investment is based on official statements with respect to the open door policy and the economic reform process: there was almost no foreign capital investment in China before economic reform. During the economic reform period, the establishment of Special Economic Zones (SEZs), economic and technology development zones (ETDZs) and the Pudong

New Development Area has boosted foreign capital investment inflows. All the areas that benefit greatly by the open door policy are located along the coast. For example, two coastal cities, Guangzhou and Shanghai, take the lead in both economic development and attracting foreign investments. The reasons that they are favored by foreign investors are not only their easier access to the international market, but also their leading roles in China's open door process to the outside world. Their easier access to the international market is because both of them are major port cities and have close relationships with Hong Kong, Macao and Taiwan. Further their leading roles are clear from the fact that Guangdong Province has three out of four SEZs while Shanghai has the biggest open area in China – Pudong. Hence the high share in foreign investment of these two regions may be attributed to their favored conditions granted by the open door policy.

On the other hand, compared with the concentration of foreign investment in coastal areas, SOEs' investment and domestic private investment distribute rather evenly at national level. This different geographical distribution pattern should be attributed to the less favored policy that inland regions receive. In general, coastal areas receive a considerably higher share of capital investment than inland areas, which would account for higher economic growth.

From the above analysis, we may conclude that policy is a determining factor for the distribution patterns of disaggregated capital investments. In particular, egalitarian policy shaped the distribution pattern of public investment before the economic reform. The open door policy leads to the highly concentrated distribution of foreign investment after the reform. Thus it is appropriate to use the geographical distribution of the disaggregated capital investments as a proxy for policy influence.

IV. Empirical Modeling and Application

To trace factors leading to the enlarging coast-inland income gap, first we consider the sources leading to the regional economic growth patterns. Since coastal and inland areas receive a different distribution of capital investment in different ownership, the disaggregation allows us to investigate the different roles displayed by the various ownership structures in shaping income inequality. Moreover, the geographical distribution of capital investment is very much influenced by policies. Thus, the different geographical distribution of ownership is capable of capturing different policies that government applies to different regions.

On the other hand, we use distance by railway, from each province's capital city to its nearest port city, as a measure for regional geographical location; more specifically, to see whether this region is far from coastline or not. From a table of the railway distances between major Chinese cities, four coastal cities have been picked out as the major port cities – Tianjin, Shanghai, Guangzhou and Haikou, for the analysis. The first three are the large port cities with great freight handling capabilities; there selection is straightforward. The fourth one – Haikou is chosen as it is the capital city of an island province – Hainan. Since Hainan has no railway connections with other parts of China, Haikou is in fact the only choice as the port city for the international trade of Hainan province, especially when railway distance is chosen as the major transportation means. The further away a province is located from these port cities, the higher transportation costs will be, and thus the harder it will be for such a province to gain foreign investment.

This paper resorts to the Solow growth model to study the influences of policy factors and geographical factors on regional economic growth patterns. First we look at the Solow growth model based on a Cobb-Douglas production function:

$$Y_t \ ? \ K_t^{?} (A_t L_t)^{1??} \qquad 0 ? ? \ ? 1 \tag{1}$$

where Y_t is the output level, K_t is the capital stock, L_t stands for labor, and A_t represents the technological development level. L_t and A_t are assumed to grow at rates n and g respectively. As derived in Wang (2003); but omitting time effects, the dynamic model of the level of per capita GDP is:

$$\ln(Y/L)_{it} \ ? \ ?_i \ ? \ ?_0 \ln(Y/L)_{i,t?1} \ ? \ ?_1 \ln p_{it} \ ? \ ?_2 \ln s_{it} \ ? \ ?_{it} \tag{2}$$

Suppose s is the share of savings to GDP and p stands for population growth rate, we also assume that investment in each region consists of a fixed part of investment due to fixed costs and an additional part of investment due to transportation costs, then distance plays its role through the influence on transportation costs in our model:

$$I(t) \ ? \ sY(t) \ ? \ FC \ ? \ DC \tag{3}$$

in which FC stands for the fixed costs and DC stands for the transportation costs.
From the above equation, we can derive

$$s \ ? \ \frac{FC \ ? \ DC}{Y} \ ? \ \frac{FC}{Y} \ ? \ \frac{DC}{Y} \ ? \ s_1 \ ? \ s_2 \,. \tag{4}$$

Thus taking logs of the above gives

$$\ln s \ ? \ \ln(s_1 \ ? \ s_2) \ ? \ \ln[s_1 \ ? \ (1 \ ? \ \frac{s_2}{s_1})] \ ? \ \ln s_1 \ ? \ \ln(1 ? \frac{s_2}{s_1}) \ ? \ \ln s_1 \ ? \ (\frac{s_2}{s_1}) \ ? \ \frac{1}{2}(\frac{s_2}{s_1})^2$$

$$\text{for all } \frac{s_2}{s_1} \ ? \ 1. \tag{5}$$

It is reasonable to suppose s_2/s_1 ? 1 considering that the transportation costs normally will not surpass the fixed costs for a specific investment project. Now substituting the investment equation (5) into equation (2) gives

$$\ln(Y/L)_{it} \; ? \; ?_i \; ? \; ?_0 \ln(Y/L)_{i,t?1} \; ? \; ?_1 \ln p_{it} \; ? \; ?_2[\ln s_{1i,t} \; ? \; \frac{s_2}{s_1} \; ? \; \frac{1}{2}(\frac{s_2}{s_1})^2] \; ? \; ?_{it} \quad (6)$$

In the above model, $?_i$ represent the unobserved regional characteristics such as cultural features, economic development levels, *et al*; *Y/L* stands for per capita real GDP at 1991's prices. The data used are from the Chinese Statistics Yearbooks from 1994 to 2000. Per capita real GDP is used to measure regional income. GDP indices are used to deflate GDP in current price to 1991 constant prices. Total investment in fixed assets is the proxy for capital investment. Its ratio to GDP, represented by s_1, is further disaggregated by its ownership structure. s_2/s_1, which is the ratio of transportation costs to fixed costs, is proxied by the railway distance from each region's capital city to its nearest port city. This railway distance variable is measured in 1000 km. For example, Urumqi, the capital city of Xinjiang Autonomous region that has the longest distance from its nearest port city, is measured to be 3.911 (?1000 km) roughly. On the other hand, it is noted that the distance of all the four port cities on their own are specified as 0.001 (?1000 km), since being a port city does not mean zero transportation cost, though this cost might be rather less.

Our time dummy is set to be 1 if years are between 1994 and 1996 and 0 otherwise, that is

$$?_0 \; ? \; 1 \text{ if years? [1994, 1996] \& } ?_0 \; ? \; 0 \text{ otherwise} \quad (7)$$

Allowing for one-year lag, our data starts from 1994. We choose 1996 as the transition year as the Asian Financial Crisis happened in 1997, which had affected the inflow of foreign investment into China significantly. As demonstrated in figure 4, both the FDI to GDP ratio and the foreign investment to GDP ratio decrease faster after 1997, while only the domestic private investment ratio shows an upward trend and increases even faster afterwards. Based on these facts, those changes are then captured by modifying our regression equation (6) to be

$$\begin{aligned} &\ln(Y/L)_{it} \; ? \; ?_{i} \; ? \; ?_{0} \ln(Y/L)_{i,t?1} \; ? \; ?_{1} \ln p_{it} \; ? \; (?_{2sc} \; ? \; ?^{*}_{2sc} ?_{0}) \ln ssc_{it} \\ &? \; (?_{2f} \; ? \; ?^{*}_{2f} ?_{0}) \ln sf_{it} \; ? \; (?_{2r} \; ? \; ?^{*}_{2r} ?_{0}) \ln sr_{it} \; ? \; ?_{3} \frac{s_2}{s_1} \; ? \; ?_{4} \frac{1}{2} (\frac{s_2}{s_1})^2 \; ? \; ?_{it} \end{aligned} \qquad (8)$$

[Figure 4 here]

GMM estimation has been carried out using **PcGive 10**. This estimator follows Arellano and Bond (1991), which was then modified by Windmeijer (2000) to correct the standard errors generated by the two-step GMM estimator. Lags of more than two years of the dependent variable are employed to construct the GMM IV matrix, and the analysis uses both the first-difference transformed data set and the levels data. We assume that the error terms are serially un-correlated. The empirical analysis results are given in table 4, together with the test results. Before starting to interpret the analysis results, we first check the validity of our assumptions using the test results. The Sargan and AR (1) and (2) tests are all based on two-step GMM estimation results. Firstly, the Sargan test shows that we cannot reject our hypothesis that the instrumental variable matrix is valid. Secondly, from the AR test, apparently AR (1) has negative and significant results while AR (2) has insignificant results. The idea of AR tests is that, if error term is not serially correlated, the differenced error term will be first order negatively correlated and second order serially un-correlated. Therefore it can be concluded that the hypothesis of serial un-correlation in the error term cannot be rejected.

[Table 4 here]

Now we start to interpret the empirical analysis results. As in table 4, both one-step and two-step GMM estimation results are listed, though two-step results are normally regarded as more efficient than one-step. Firstly we look at the convergence speed. The convergence speed calculated from the two-step GMM estimation results is about 15.6% annually, which indicates that those regions need 4.44 years to halve the deviation from their own balanced growth paths. Population growth displays negative effects on economic growth.

The second point, which is also the most important part to be interpreted in table 4, is the role of different ownership structures on economic growth. From the elasticities of ratios of disaggregated capital investment/GDP to per capita GDP, the results clearly suggest that the components of disaggregated capital investments exhibit quantitatively different influences on the national economy. In particular, domestic private investment has the highest elasticity in the estimation, which is 3.3 + 3.2 = 6.5% with time dummy and 3.3% without, both significant at the 10% level. On the other hand, public investment proves to be insignificant, with and without time dummy. Thus during the whole data period, domestic private investment has a positive influence on economic growth, while public investment shows an insignificant effect. Further, the estimated elasticity of foreign investment changes from insignificance with time dummy to 2.8% without. Therefore, foreign investment has a similar positive effect throughout data period.

Thirdly, we start to analyse the influence of transportation costs on economic growth. The results from table 4 show that distance (**Distance)** has a negative sign, while the squared distance (**Sq distance**) has a positive sign. If we write the distance components in equation (8) as $?_3 d \; ? \; \frac{1}{2} \, ?_4 d^2$, there is a minimum at a positive value:

$$d \; ? \; \frac{?_3}{?_4} \tag{9}$$

as $?_3 \; ? \; 0$ and $? \, \frac{1}{2} ?_4 \; ? \; 0$

Applying equation (9) to the two-step estimation results in table 4, which gives that $?_3 \; ? \; ?0.1315$ and $?1/2 \, ?_4 = 0.0304$, both significant at 1% level, the minimum can then be found at a distance of 2.16 (?1000 km) to the nearest port city.

To calculate the 95% asymptotic confidence interval, the delta method is used, to produce (1.87, 2.45). According to this distance, from our data set, it can be seen that there are four regions located on the right hand side of the minimum point, which are Sichuan, Yunnan, Qinghai and Xinjiang; while all the others are located on its left hand side. Indeed, only one region, Xinjiang, lies to the right of the confidence interval. In figure 5, the relationship between the distance and the economic development level is illustrated. The model predicts, *ceteribus paribus*, a reduction of growth as distance increases, with a diminishing marginal effect, until the minimum is reached. The data exhibit growth reducing with distance, except for Xinjiang. However, the distance effect is limited.

[Figure 5 here]

VI. Conclusion

This paper examines the role of disaggregated capital investments and the function of geography in regional economic growth. When coastal-inland inequality becomes the major source of income inequality in China, the geographical factors are found to be important in influencing the regional economic growth patterns. To single out the role played by geography in determining economic growth, a coastal dummy has been employed by a number of economists. However, we would argue that this dummy is not able fully to represent the influence of geography on economic growth, and it is also correlated with other regional effects, such as policy influences.

To separate policy factors and geographical factors influencing regional economic growth, two terms are employed in this paper; the geographical distribution of disaggregated capital investments and railway distances.

Being influenced by the policies, different distribution patterns of the public, foreign and domestic private investments are observed in different regions of China. Since all the SEZs and ETDZs are located in the coastal areas, there is no doubt that they are more favored than inland areas by foreign investors, and this leads to the concentration of foreign investment in these areas. At the same time, public investment is more evenly distributed geographically due to the strict government control of the SOEs; this reflects the political consideration that inland areas are far from the coast and thus away from any possible conflict.

On the other hand, the economic reform process in China is also accompanied by the rapid development of the domestic private sector. While the influence of public investment on the economic growth is becoming less and less, as is implied by our nonsignificant estimation results, the influence of the domestic private sector grows rapidly during the 1990s, which is also clearly shown from the positive estimated elasticity of the ratio of the domestic private investment/GDP to per capita income.

Geographical factors have been taken into consideration by introducing the transportation costs, which are proxied by the railway distance from the capital city of each region to its nearest port city. Since longer distances lead to higher transportation costs and thence more obstacles to investors, it is reasonable to assume that regions located further from coast tend to have lower GDP per capita when other conditions remain the same, and this matches fairly well with the fact that a typical inland area is growing less rapidly than a typical coastal area. Therefore, distance plays a negative role in economic growth. However, such a negative effect would increase more slowly as distance increases. The most distant region, Xinjiang, appears to be an outlier, but rail may not be so dominant a means of transport in this case.

The analysis of this paper identifies two major reasons for inland areas to lag far behind coastal areas in terms of economic development: (a) lack of foreign and domestic private investments, (b) their greater distance from the coast. Therefore, to attract more private investment, and to provide a better transport infrastructure, may be the means for the inland areas to develop faster and reduce the coast-inland income gap.

Table 1. Variance decomposition for figure 3

Year	? -Coast	? -Inland	? -Between	? -Aggregate
1993	0.444	0.229	0.351	0.486
1994	0.439	0.231	0.373	0.500
1995	0.424	0.235	0.380	0.501
1996	0.431	0.237	0.379	0.504
1997	0.438	0.243	0.384	0.511
1998	0.442	0.245	0.391	0.518
1999	0.448	0.245	0.399	0.527

Table 2. Ratios of disaggregated capital investments to GDP

s : ratio of capital investment to total GDP.	
Lnssc = ln((total investment in fixed assets by SOEs + COEs) / total GDP)	(Log) Ratio of **Public** investment to GDP
lnsf = ln((total investment in fixed assets by FOEs + OCEs) / total GDP)	(Log) Ratio of **Foreign** investment to GDP
lnsr = ln(The rest of total investment in fixed assets / total GDP)	(Log) Ratio of **Domestic private** investment to GDP

Table 3 Capital investments in fixed assets to GDP ratio (1991-1999)

	Coastal (Ratio)	Inland (Ratio)	Ratio (Coastal/inland)
Total investment in fixed assets to GDP	0.370	0.298	1.243
Public investment to GDP	0.261	0.231	1.128
SOEs investment to GDP	0.202	0.207	0.976
COEs investment to GDP	0.059	0.025	2.397
Foreign investment to GDP	0.056	0.012	4.542
Total investment by foreign-funded enterprises to GDP	0.039	0.009	4.465
Total investment by Overseas Chinese-funded enterprises to GDP	0.017	0.004	4.743
Domestic private investment to GDP	0.071	0.062	1.160

Table 4. Estimation of Disaggregated capital investments ratios

Ln per capita real GDP$_{it}$		I	
		GMM-1	GMM-2
Ln per capita real GDP$_{it-1}$		0.8505 (41.5)***	0.8552 (40.7)***
Ln Population growth		-0.0333 (-1.95)*	-0.0286 (-1.66)**
Ln public investment to GDP ratio		0.0212 (1.26)	0.0154 (0.748)
	$?_0$	-0.0164 (-0.771)	-0.0199 (-0.953)
Ln Foreign investment in fixed asset to GDP ratio		0.0293 (2.0)**	0.0281 (2.21)**
	$?_0$	-0.0160 (-1.39)	-0.0143 (-1.06)
Ln Domestic Private investment to GDP ratio		0.036 (1.92)*	0.0328 (1.76)*
	$?_0$	0.0329 (1.87)*	0.0320 (1.79)*
Distance		-0.1287 (-5.70)***	-0.1315 (-4.48)***
Sq distance		0.0302 (5.61)***	0.0304 (4.10)***
Constant		1.4627 (7.24)***	1.4276 (6.56)***
RSS		0.4998	0.4812
Sargan test		Chi^2 (35) = 17.36 [0.995]	
AR(1)		-2.040 [0.041]**	
AR(2)		0.4714 [0.637]	
No. of Observation		196	196
?-calculated		0.162	0.156
t-calculated		4.278	4.443

Note:
***Significant at the 0.01 error level.
** Significant at the 0.05 error level. * Significant at the 0.10 error level.
Both one-step and two-step GMM estimation results are listed.
t-value in ( ). P-values in [ ].
Sargan and AR(1) and AR(2) tests are based on the two-step results.

Figure 1

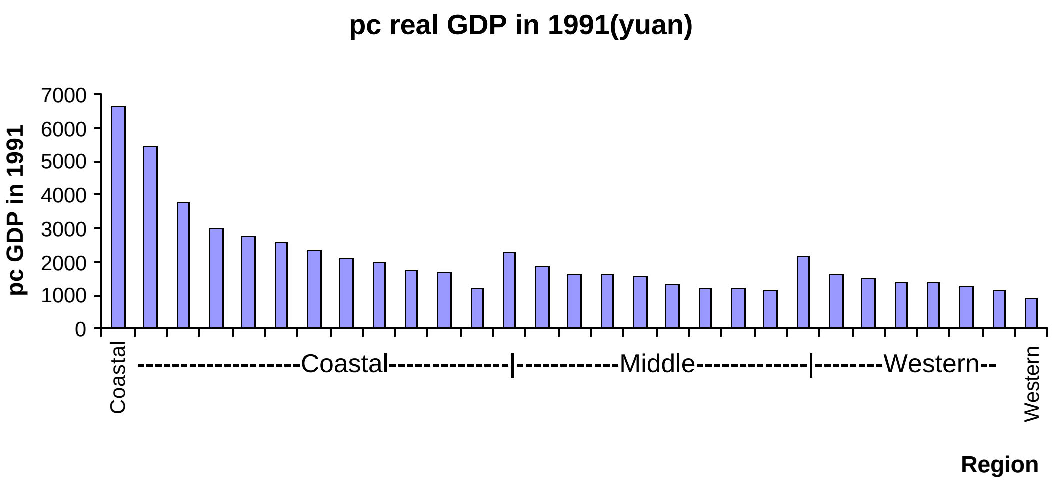


Figure 2

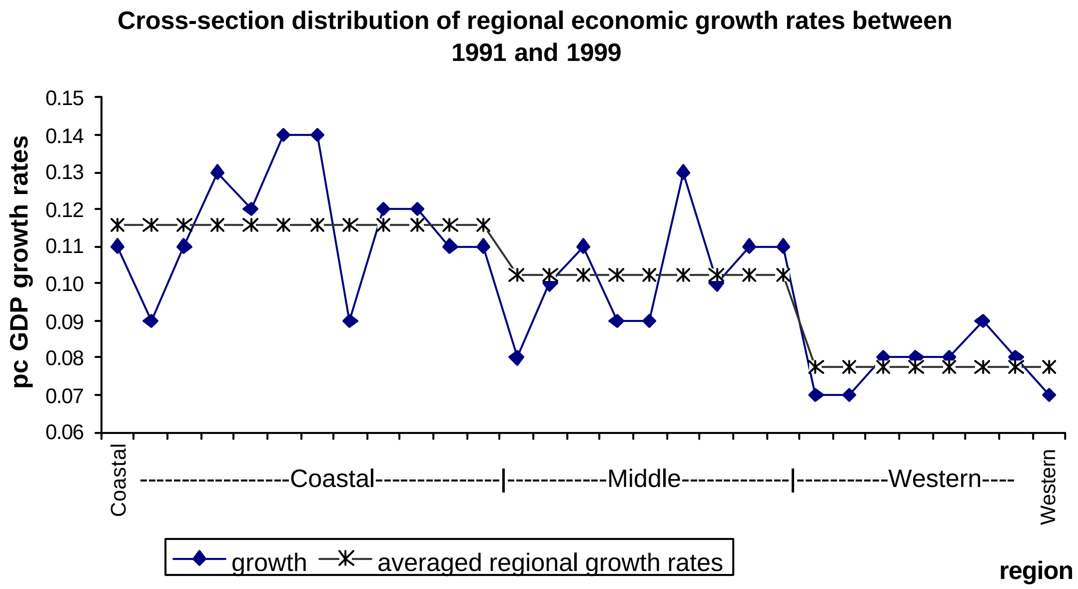


Figure 3

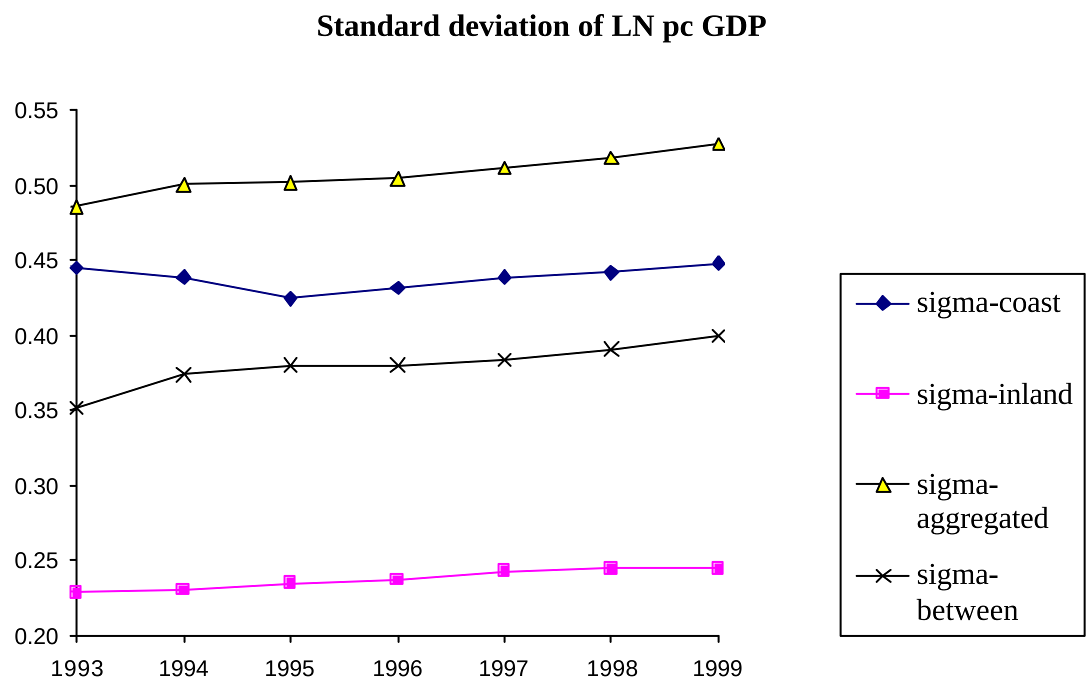


Figure 4

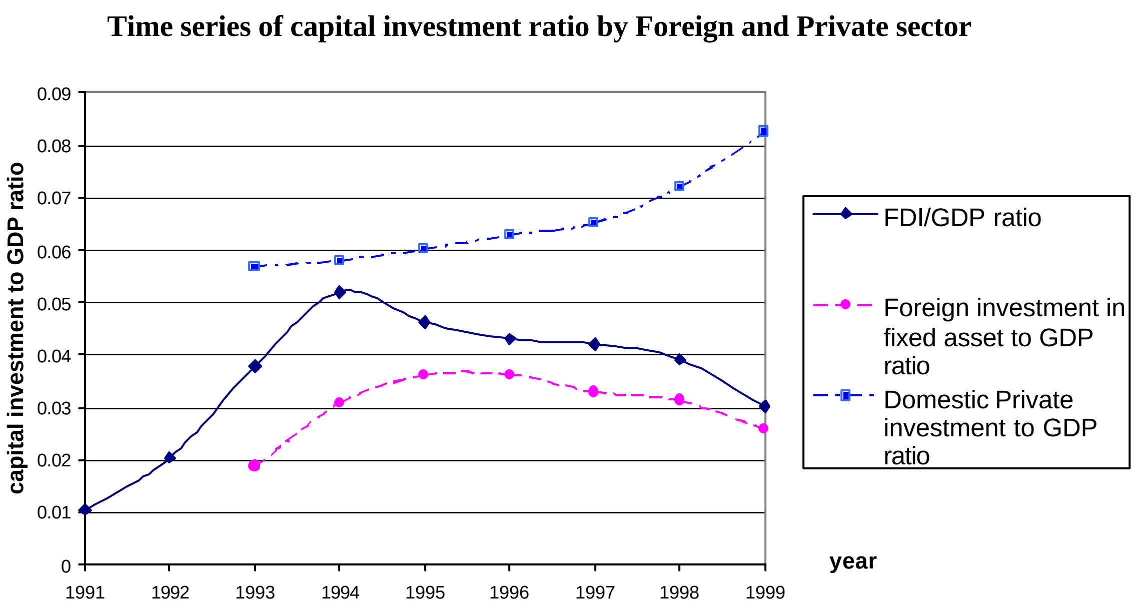
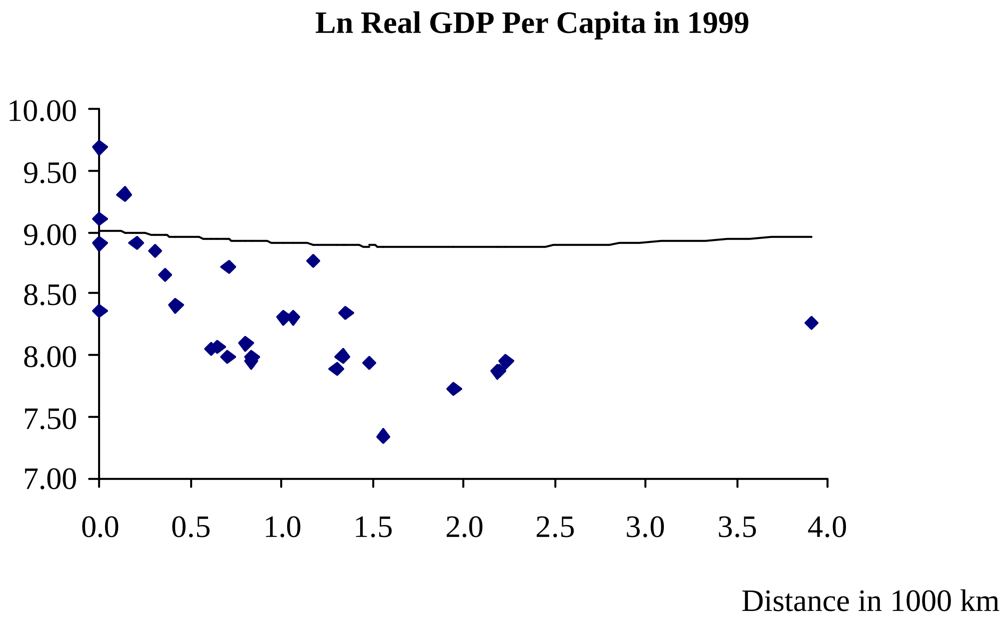


Figure 5



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