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Are There Spillover Effects Between Coastal and Non-Coastal Regions in China ?[1]

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Abstract

The evolution of regional policy between the Mao era and the Deng era generated much debate concerning inter-provincial disparities and the trade-off between efficiency and equity. The aim of this paper is to explore the existence of regional growth spillover effects looked for Deng's policy. Indeed, the main objective was the spread of coastal provinces' growth onto inland provinces' growth. After reviewing the theoretical underpinnings of such effects, their existence is tested with panel data, for the period 1981-1998. Moreover, the hypothesis of an equal distribution of these effects over all the inland provinces is also tested. A relative failure to boost development of the western provinces from the coastal provinces' growth is observed. Hence, it would seen to be an error to wait for spillover effects to be sufficient to reduce disparities between Chinese provinces in the short run.

JEL classification: O53, O40, R58.

Key words: China, growth, regions, spillover effects, panel data.

Résumé

L'évolution de la politique régionale chinoise entre la période de Mao et celle de Deng a engendré un large débat concernant les disparités inter provinciales et le trade-off entre efficience et équité. L'objectif de la politique initiée par Deng était que la croissance des région côtières devait se diffuser à l'ensemble des régions intérieures. Ce papier cherche à tester l'existence de tels effets de report. Après avoir présenté les fondements théoriques de ces effets de report, un test sur des données régionales en panel est réalisé sur la période 1981-1998. De plus, l'hypothèse d'une répartition uniforme de ces effets de report entre les régions intérieures est aussi testée. On constate une absence d'effet de la croissance des régions côtières sur les régions de l'ouest. Donc, il apparaît assez vain de compter sur ces seuls effets de report pour réduire les disparités entre les provinces chinoises, au moins à court terme.

Mots-clés : Chine, Croissance, Régions, Effets de report, Panel.

INTRODUCTION

Since the beginning of the 80's, the regional dimension has been crucial in Chinese policy. It is obvious that the size and the geography of the country lead to the role of the regions (or provinces) being emphasized. The relaxation of control by the central government divested greater responsibility to the regions. The reform also altered the relationships between the center and the provinces. First, central government moved from the policy of control through direct administration of the economy to one based on macro-economic management (see Goodman and Segal, 1994). Second, the fiscal relationships between the center and the provinces changed drastically, giving more power to the latter.

At the beginning of the Mao period, the regions were characterised by wide disparities that the development strategy aimed to curtail. The First Plan (1953-1957) had to correct for the supposed irrational spatial distribution of Chinese industry. Consequently, the local authorities were encouraged to promote self-reliance. "Unlike previous Chinese governments, the communist leadership was able to tap a powerful war-state to rectify China's regional imbalance" (Yang, 1997). So, one of the main goals was to reduce inter-regional imbalances. At the same time, there was also a strong desire to enhance China's national defence and most of the considerations concerned military strategy. So, most investments were devoted to the inland regions and not to the richer coastal ones. Nevertheless, at the end of this period, coastal regions had kept their superiority in terms of infrastructure and skills.

The regional policy changed with Deng Xiao Ping, who reversed the strategy and emphasized international trade openness and thus, the valorization of regional comparative advantages. In order to implement this, the government chose to experiment with the "Open Door Policy" in two provinces: Guangdong and Fujian. These two provinces had close relations with Hong Kong, the United States and Europe even during the Mao period. The

central government gave them certain advantages, especially by creating Special Economic Zones. This policy was reinforced by the creation of 14 coastal cities which were given preferential treatment. The objective was to promote growth in coastal regions with the idea that there would be spillover effects between these regions and inland regions. The Sixth (1983-1986) and Seventh (1986-1991) Plans were based on the assumption that economic development tends to diffuse spatially through technological transfers. Even if this hypothesis was been discussed, "the Chinese leadership has opted to favor growth at the expense of some equity, at least in the short and intermediate run" (Yang, 1997). The international openness of coastal regions was very important during the 80's but inter-regional protectionism was maintained. Hence, among others, these local trade barriers acted against the strategy of promoting the diffusion of growth.

A main characteristic of chinese economy is the structural gap between the coastal provinces and the other ones. But a strong heterogeneity is also observed among the latter and, it is usual to distinguish between central and western provinces. These ones are the poorest, they have few infrastructures and their comparative advantage generally rests on mining activities.

We proceed as follows: section 1 lays out the theorical underpinning of provincial spillover effcts. Section 2 tests for the existence of growth spillover effects between coastal and inland provinces, it also test if these effects spread equally over the non-coastal provinces. Section 4 concludes.

A THEORETICAL ANALYSIS OF PROVINCIAL SPILLOVER EFFECTS

Provincial spillovers can result from three kinds of externalities:

(i) demand side externalities: marginal productivity of capital depends on the beliefs of the province's investors about the demand in other provinces, especially in coastal provinces which have the highest level of per capita income.

(ii) trade externalities: transaction costs are decreasing when trade is more intensive, and then economic activity in coastal regions enhances the domestic trade in all China and consequently the growth of inland provinces.

(iii) supply side externalities: these result from technical knowledge and the diffusion of managerial skill. In a long term growth perspective, one may suppose the predominance of this kind of externality.

Supply spillovers may be channelled by domestic trade between coastal and non-coastal provinces. Technological innovations embodied in foreign capital goods (Grossman and Helpman, 1991) diffuse to inland provinces from coastal provinces' imports. Moreover, the competition on the domestic market may induce inland firms to adopt the technology of coastal firms.

Another important channel is foreign direct investments (FDI), as domestic firms imitate technologies created by foreign firms (de Mello, 1997). With the "Open Door Policy", the coastal provinces, notably Guangdong and Fujian, were allowed to attract FDI and so local firms captured some benefits (learning by doing, technological transfer, intermediate goods

demand and access to foreign markets). Some firms from inland regions relocated part of their production process to try to obtain the same benefits. It is a way to diffuse this type of externalities from coastal to inland regions.

When a coastal province invests in an innovative project, the latter can be considered as a free countrywide market study that improves economic information available to inland provinces. In this way, the pioneering spirit of coastal provinces is supposed to benefit to inland provinces.

Moreover, there must exist an imitation process of policies between provinces. It is easy to understand why good policies may be copied (for instance the household responsibility system, attraction of FDI). This process may be observed in many countries, but in the case of China it has been strongly encouraged by the central government whose target was to experiment with a policy in coastal regions and then to extend this policy to all provinces. However, bad policies may also be contagious according to local government rent-seeking.

At last, an inland province may benefit from public capital goods provided by coastal provinces. When a province invests in roads, telecommunications, airports and ports, other provinces are favored, as price exclusion is not possible. The same mechanism is at work concerning public investments in human capital, *i.e.* health and education. It is certainly the case with the Special Economic Zones which concentrated the majority of investments in infrastructure, finance, and tourism.

AN EMPIRICAL ANALYSIS OF REGIONAL SPILLOVER EFFECTS

The test of provincial spillover effects is based on the estimation of a growth equation derived from the empirical framework proposed by Barro (1991):

$$GROWTH_{it} = \alpha_1 GDP_{it} + \alpha_2 ICGROWTH_t + \alpha_3 POPGR_{it} + \alpha_4 POP_{it} + \alpha_5 INFLA_{it} + \alpha_6 FDI_{it} + \alpha_7 SOE_{it}$$

$$+ \alpha_8 EDU_{it} + \alpha_9 INV_{it} + \alpha_{10} ROAD_{it} + \sum_{j=1}^{p} \beta_j WESTERN_{itj} + \sum_{k=1}^{q} \mu_k CEN\,\mathrm{TR}\,AL_{itk} + \sum_{l=1}^{r} \theta_l COASTAL_{itl} + \phi_i + \varepsilon_{it}$$

where the subscript *i* refers to the provinces, *t* refers to time, *j*, *k* and *l* denote western, central and coastal provinces respectively. f_i are specific provincial effects and e_{it} is the error term.

The growth rate of real GDP per capita ($GROWTH_{it}$) is regressed on two categories of variables:

(i) test variables *ie* provincial variables capturing spillover effects;

(ii) control variables generally used in growth regressions across provinces in China.

We test if the coastal real GDP growth rate affects the real GDP per capita growth rate of non-coastal provinces. Positive spillovers among coastal provinces are included. Moreover, this method allows for spillover effects to be different across provinces.

For this, the unweighted mean of the coastal growth rate is calculated. This mean is then multiplied by dummies which take the value one for the considered province and zero for the others. The resulting variables are equal to the mean growth rate of coastal regions for the

province concerned and zero otherwise. Two groups of variables are considered according to their geographical location: central ($CENTRAL_{itk}$) and western ($WESTERN_{itj}$)[2].

Coastal growth may also affect coastal provinces. Thus, for each of them, we calculate coastal growth excluding the considered province ($COASTAL_{itl}$) [3]. Hence, the means are different for each coastal province. These means are multiplied by dummies which take the value one for the considered coastal province and zero for the others.

This work includes the usual control variables. According to the hypothesis of decreasing rate of return, the expected impact of the logarithm of the initial real per capita GDP (GDP_{it})[4], a proxy for the stock of physical capital (Barro and Sala-I-Martin, 1995), is negative. Thus, poor provinces should grow faster to their steady state than wealthier ones (b-conditional convergence).

Among the control variables, the international economic environment is captured by the rate of growth of the real GDP of industrial countries ($ICGROWTH_t$)[5]. It catches an explanatory factor whose effect is expected to be the same across provinces. The omission of this variable may result into a simultaneous bias. A positive sign is expected.

The population (POP_{it}) should affect economic growth positively through economies of scale. The population growth rate ($POPGR_{it}$) is a rough proxy for the reproduction rate and

[2] Central provinces are: Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Anhui, Hubei, Jiangxi and Hunan. Western provinces are: Xinjiang, Qinghai, Sichuan, Gansu, Shaanxi, Guizhou and Yunnan. Tibet, Ningxia and Chongqing are exclused because of lack of data.
[3] For instance, for Beijing, the coastal growth mean is calculated on the following provinces: Liaoning, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Hainan and Guangxi.
[4] The deflator is the provincial retail price index.
[5] To catch the same effect, other variables were included in the regression such as: terms of trade, the rate of growth of the real GDP of China's trade partners, none appeared significant.

so, should affect economic growth negatively, as high fertility implies an increase in the opportunity cost of economic activity (Barro and Sala-I-Martin, 1995).

A regional inflation rate ($INFLA_{it}$) is included to take into account the variability of inflation across the provinces. Inflation generates distortions in the structure of relative prices which lead to an inefficient allocation of resources. Moreover, inflation is positively correlated to its instability and thus, increases risks for decision making. Finally, inflation drives resources to governments and public spending may be less efficient than private spending. So, a negative impact of inflation on GDP growth is expected (Brun, Chambas and Combes, 1998).

The share of foreign direct investments in fixed capital investment (FDI_{it}) is included in the regression. A social or private productivity gap between domestic and foreign investments may explain a positive influence of FDI on economic growth. Several mechanisms can play a role. First, FDI promote technological transfers from industrial countries. Second, FDI may strengthen the managerial skills of domestic firms. Third, the access to world market is easier for Chinese products (Chen, Chang, and Zhang, 1995). Finally, FDI is a proxy for the international openness of the provinces, which strengthens the competitiveness, extends the market size and promotes the access to more technologically intensive intermediate goods.

State-owned enterprises are experiencing rather poor performances. The main explanation is the lack of adaptability to market rules: redundant employees, obsolete technologies, poor managerial skills and social and political constraints (Chen and Feng, 2000). Therefore, the importance of state-owned enterprises is measured by the ratio of state-owned staff and workers to the total number of employed persons (SOE_{it}). It is expected to exert a negative impact on growth.

Barro and Sala-I-Martin (1995) use different school enrollment rates as proxies for human capital. In China, due to mandatory primary education, the most significant gaps between provinces concern secondary and higher education. The correct denominator of these rate is the total population of the corresponding age group. As these data are not available at a provincial level, the school enrollment rate is calculated as the number of students enrolled in higher education relative to the total provincial population.(EDU_{it}) [6]

An exogenously higher value of the ratio of domestic investment to GDP (INV_{it}) increases the steady state level of output per capita and hence the growth rate. Investment is measured with gross fixed investment data.

It is obvious that the positive impact of infrastructures on growth must be integrated. The variable chosen in this paper is the length of the roads in each province *($ROAD_{it}$).*

The data set includes 28 provinces and so 168 observations as each province is described by 6 observation points covering the following periods: 1981-1983, 1984-1986, 1987-1989, 1990-1992, 1993-1995 and 1996-1998. The sample concerns the post-reform era, where the growth of each province largely results from its own structural characteristics and from decentralized policy choices. The variables are averaged over each of the five periods.

The econometric method is based on panel data technique (Islam, 1995). It allows us to take into account some unobserved provincial heterogeneity. Two-stage least squared method takes into account the positive impact of growth on investment.[7]

[6] The school attainment variables, which record average years of schooling, are not available.
[7]The ratio on investment to GDP is instrumented by the same ratio on the three preceding years, by some other lag variables, as inflation or openness and by infrastructure variables.

Data are taken from *Comprehensive Statistical Data and Materials on 50 Years of New China* (Department of Comprehensive Statistics of National Bureau of Statistics, China Statistics Press, 1999). The GDP growth rate of industrialized countries and the exchange rate, to convert FDI from US dollars into Yuans, are taken from *International Financial Statistics Yearbook 2000* (IMF).

Table 1 : Regression results

Variables	Coefficients	T statistic	P value
GDP	-0.069	4.708	0.000
ICGROWTH	0.003	1.401	0.164
POPGR	-2.910	2.711	0.008
POP	5.54^{E}-09	2.956	0.004
INFLA	-0.130	2.853	0.005
FDI	0.110	1.924	0.057
SOE	-0.600	2.960	0.004
Groups of Provinces	Mean of coefficients	F-test	P value
WESTERN:	0 (NS)	1.280	0.270
CENTRAL:	0.54	1.980	0.050
COASTAL:	0.61	2.480	0.007
Wald test of equality of coefficients for central provinces = 0.2364 (0.988)			
$R^2 = 0.75$	R^2 Adjusted = 0.60	LM heteroskedasticity test = 25.8 (0.00)	
Hausman test (random vs fixed effects) = 434 (0.00)			

A LM test rejects the null of homoskedasticity, at less than the 1 % level, and thus the variance-covariance matrix is corrected for heteroskedasticity. A Hausman test shows a correlation between provincial effects and explanatory variables, so a fixed effect equation is retained.

All the significant variables have the expected sign (table 1). More particularly, the coefficient for initial GDP per capita is significant and negative, so, we cannot reject the hypothesis of conditional *b*-convergence between provinces. Guillaumont and Boyreau

Debray (1996), Jian, Sachs and Warner (1996), Chen and Fleisher (1996) and Chen and Feng (2000) report similar results[8]. Of course, this result does not mean a trend towards a reduction in the GDP per capita inequalities between provinces. In fact, conditional b-convergence leads to different provinces steady-state level per capita output. For instance, the high level of FDI in coastal regions gives them a higher level of welfare in the long run.

The weak significance of the variable ICGROWTH reflects the low dependence of Chinese economic growth *vis-à-vis* the overall economic situation in the rest of the world.

Three additional variables are not significant (see annex 1, table 3) :

- educational variable (EDU): two main explanations may be proposed. First, the denominator is incorrect and consequently, the differences in the age structure of the population between the provinces, may bias the results. Secondly, only short term effects of education are caught in the panel structure. We may suppose that positive effects only appear over a long period, as in Chen and Feng (2000).

- ROAD is not significant but the variable is probably poorly chosen and better data would have given more interesting results. Hence, we cannot draw definitive conclusions.

- investment (INV): exogenous shifts in the investment ratio are not significant[9].

The growth of coastal provinces affects the groups of provinces considered differently. Regarding western regions (WESTERN), the impact is non-significant. On the contrary, coastal growth acts positively and significantly on central provinces (CENTRAL) and, a Wald test does not reject the null that the coefficients for central provinces are equal. Moreover, spillover effects can be observed within coastal provinces (COASTAL). This result tends to

[8] See Naughton (2001) for a discussion of these results.

show that coastal growth benefits to inland provinces unequally. Central provinces seem to take more advantages than western provinces from coastal development. With a different theoretical framework (core-periphery model), and a different method (detection of spatial correlation), Ying (2000) does not reject the hypothesis of an unequal diffusion of coastal growth between inland provinces.

Some explanations can help our results to be understood. The first is that location and geography matter in the diffusion of growth (Moreno and Trehan, 1997) either via transportation costs or via monitoring costs (confidence, common knowledge) which decrease with cultural proximity, probably correlated to geographical proximity.

The second is that some kinds of spillovers are particularly effective in cities (Glaeser, Kallal, Scheinkman, and Shleifer, 1992). The reason is due to agglomeration effects, more present in central provinces, where there are more cities than in western provinces. Whatever the size of the city may be, they are always much more numerous in central than in western provinces (Batisse, Brun, Renard, 2001).

The third explanation probably comes from differences in the level of development (GDP per capita or rate of industrialization…). The western regions do not benefit from the coastal growth because the economic distance may reduce, even annihilate, regional spillovers.

The unequal diffusion of growth induces more regional disparities. It is, at the present time, one of the main preoccupations of the central government with respect to potential social and economical implications. To draw conclusions from our results, it would be interesting to project some trends. Considering the 1998 GDP per capita and the predicted

[9] For a same result, see Barro and Sala-I-Martin, 1995.

value of the growth rate, income gaps between groups of provinces are estimated for the next fifteen years.

Table 2 : Income ratio between group of provinces

	Coastal/Central	Coastal/Western	Central/Western
1998	2.02	2.55	1.26
Projection (15 years)	2.45	3.88	1.58

As spillover effects are heterogeneous, the gap between coastal and western provinces will be greater than between coastal and central provinces. So, the risk is to generate negative externalities due to an extreme concentration of population and economic activities in certain coastal places, which is at once inefficient and inequitable.

4. Concluding remarks

The relative failure to boost the development of western provinces from coastal regions growth or “ladder step policy”, shows that it is an illusion to hope that spillover effects may be sufficient to reduce disparities between all Chinese provinces. Now, the challenge is crucial for Chinese social stability and to avoid the risks of fragmentation and massive inter-regional migrations. This observation leads the central government to give priority to public investment in western regions in the next Five Years Plan (2001-2005). . Most of previous investments concern infrastructure, for instance airports, highways and pipelines. The aim is to help these provinces to profit more from their international comparative advantages.

We may think that if all the regions implement an outward looking strategy, less disparity may be expected. But in any case, the central government will keep a crucial role through its redistribution policy via permanent transfers.

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ANNEX 1

Table 3 : Regression results

Variables	Coefficients	T statistic	P value
GDP	-0.066	3.940	0.000
ICGROWTH	0.002	0.657	0.513
POPGR	-3.058	2.610	0.010
POP	5.93^{E}-09	3.372	0.001
INFLA	-0.134	3.115	0.002
FDI	0.107	1.764	0.081
SOE	-0.585	2.221	0.029
EDU	-4.218	0.993	0.323
ROAD	-2.22^{E}-07	0.302	1.763
INV	0.055	0.499	0.619
F test (*INV*+*ROAD*+*EDU*) = 0.290 (0.830)			
R^2 = 0.76	R^2 Adjusted = 0.61		