CSCanada
Canadian Social Science
Vol. 8, No. 2, 2012, pp. 231-236
DOI:10.3968/j.css.1923669720120802.2710

ISSN 1712-8056[Print]
ISSN 1923-6697[Online]
www.cscanada.net
www.cscanada.org

Does Strategies of Industrial Development Cause Spatial Convergence: Evidences from Changsanjiao, Zhusanjiao and Huanbohai of China

EST CE QUE LES STRATEGIES DU DEVELOPPEMENT INDUSTRIEL PROVOQUERONT LA CONVERGENCE SPATIALE: LES EVIDENCES DE LA ZONE TRIANGULAIRE, ZHUSANJIAO ET HUANBOHAI DE CHINE

SUN Yang[1,*]

[1] Institution of Urban and Regional Economics, Nankai University, Tianjin, China.
[*]Corresponding author.

Received 13 January 2012; accepted 20 April 2012.

Abstract

Three topics, "the convergence of the economic growth", "the influences of regional industrial development strategies to the economic development", and "spatial effects in regional growth" are studied in the empirical analysis. Spatial panel data model and the nonnested tests of spatial structure are first used in the studies of China cities' spatial structures. Empirical results show there are β-convergences in "Changsanjiao" and "Huanbohai" districts during 1990-1998 and the adjustments of the regional industrial development strategies adapting to the regional endowments play important parts in the economic growth. Meanwhile, the growths of the cities in the three districts have significant spatial effects that cities with similar per capita GDP levels promote each other in their growth processes.

Key words: Spatial convergence; Strategies of regional industrial development; Spatial effects

Résumé

Il y a trois thèmes, qui sont ''la convergence de la croissance économique'', ''les influences de stratégies régionales en matière de développement industriel au développement économique'', et ''Les effets spatiaux de la croissance régionale'' sont étudiés dans l'analyse empirique. Les données de la Spatiale en modèle de panel modèle et les tests non emboîtés de la structure spatiale sont d'abord utilisées dans les études de structures spatiales de la Chine des villes. Les résultats empiriques montrent qu'il ya des convergences dans ''La Zone triangulaire'' et la zone de ''Huanbohai'' au cours de 1990-1998 et les ajustements des stratégies régionales de développement industriel à s'adapter à des dotations régionales jouent des rôles importants dans la croissance économique. Pendant ce temps, les croissances des villes dans les trois districts ont d'importants effets spatiaux que les villes avec des niveaux similaires par PIB par habitant de promouvoir les uns des autres dans leurs processus de croissance.

Mots clés: Convergence spatiale; Stratégies de développement industriel régional; Effets spatiaux

SUN Yang (2012). Does Strategies of Industrial Development Cause Spatial Convergence: Evidences from Changsanjiao, Zhusanjiao and Huanbohai of China. *Canadian Social Science, 8*(2), 231-236. Available from URL: http://www.cscanada.net/index.php/css/article/view/j.css.1923669720120802.2710
DOI: http://dx.doi.org/10.3968/j.css.1923669720120802.2710

INTRODUCTION

The topic that whether China's economic growth has convergence according to neoclassic theory has been analyzed in a lot of papers. Nevertheless, most of these studies focus on the data of provinces while the cities have not been paid much attention. The accepted conclusion about convergence between provinces in China is as follows: Convergence of economic growth happened before 1990, and the provinces diverged from each other after that. Meanwhile, in the east, middle, and west provinces, there are conditional β-convergences separately. That is to say, China's provinces have club convergences (see Lin & Liu, 2003; Liu, Wei & Li, 2004). Some papers tried to give explanations why the club convergences happen. Cai & Du (2000) argued that human capital was the most important one. Peng (2005) made an empirical analysis about the TFP and the divergence of these provinces' growth. Fan and Zhang (2003) pointed out that the differences of labor payments could give an explanation.

Copyright © Canadian Academy of Oriental and Occidental Culture

The empirical results cannot give explanations about two problems. One is the lack of systematic analysis about the reason why the convergence happens (see Liu, 2001). The papers focus on the differences at the beginning of the development rather than the process, which gives rise the lack of discussion about why there is or is not convergence. The other is the lack of the spatial analysis about the process of growth, while regions close to each other have positive or negative spatial effects.

To answer the first question, Lin (2002a, 2002b) points out, according to the neoclassical theory' assumption that the enterprises have internal viability, theories cannot give explanation about the transforming nations, including China, not having convergence during their developing efforts. Different level of privatization, the inequality of distribution of the FDI across provinces, division of the markets and the huge gap of the investments between the east and the west of China cannot offer a convincing story why the disparity of the east and the west China keep growing (see Lin & Liu, 2003).

According Lin's theory, the choice of different strategies about growth will give rise to whether the enterprises will make their internal viability, therefore make the important reason that the convergence will happen. If the strategy conforming to the resource endowment is chosen, the growth process will follow the market economy path and enterprises will make profits. And there will be less distortion about the prices of factors, so the viability of the enterprises will be developed during the growth. The enterprises with viability will make more profits in the market and will be more viable in the upgrading of the structure of industries and factors, which makes an important reason for the economic convergences (see Lin, 2002a, 2002b). The comparative analysis cross different countries (see Lin, 2002a) and between the provinces across China (see Lin & Liu, 2003; Lin & Liu, 2003) show that the different choices about the development strategies make different impacts on the convergence of the economy.

To answer the second question, Magrini (2004) points out that, with the regression methods used to discuss the convergence problem, the spatial influences or spatial effects are often be paid no attention, which will have important structural influences on the neighboring regions. The spatial effects on the economic convergences have just come into notice on the Chinese regional analysis (see Lin, *et al.,* 2005, 2006; Wu, 2006). However, these analyses on China regional convergence with spatial effects taken into account pay less attention about two problems. One is lack of discussion about the setting of different spatial structures. The other is lack of the comparisons and tests between spatial matrix those are used to describe the spatial structures.

One more issue we have to point out is that those analyses based on the neoclassical theory about growth use the models to study the convergences across countries, which have some differences with the models adopted to analyze the problems across regions. Compared to the countries' case, the regional growth has less disturbances about the flow of productive factors, and what is more, the law, culture, language or institution will not play the same obstructing part. That is to say, the spatial influences between regions will have more effects on the growth convergence problems (see Magrini, 2004). Meanwhile, regions close to each always have similar economic endowments which will be in accordance with the neoclassic theory than countries.

In this paper we show that, strategies on industrial development and the viability of the enterprises will not only have impacts on the economic growth, but the growth has spatial effects. Compared to all the regions across China, in several typical regions, such as Changsanjiao, Zhusanjiao, and Huanbohai, the spatial influences make more obvious effects about convergence.

Three most important regions, Zhusanjiao, Changsanjiao and Huanbohai, which have 9, 16 and 13 cities respectively, are taken into consideration using the data from 1990 to 2009. Three problems are investigated in this paper. First, do the different choices of industrial strategies make effects on the economic growth and convergence? Second, if the effects exist, do they have spatial influences? And the third problem is that, if the spatial effects exist, are they complementary or competitive, that is, are the spatial effects positive or negative?

THE INDUSTRIAL DEVELOPMENT STRATEGIES

We first consider the technical choice index (TCI) using the method given by Lin (see Lin, 2002a; Lin & Liu, 2003), as an indirect measure of the choice of industrial strategies of the cities in the three regions. That is,

$$(1)\quad TCI = \frac{K_C / L_C}{K / L}$$

where K and L represent the capital stock and labor of the whole society, while K_C and L_C represent the capital stock and labor of the manufacturing sector. The level of capital stock per labor gives a measure of the endowment of capital and the corresponding ratio of the manufacturing sector represents the preference of the industrial development strategy. Lin supposes there is an optimal strategy, TCI*, corresponding to the capital endowment. Therefore

$$(2)\quad DS = TCI / TCI^*$$

measures the divergence from the optimal strategy using the ratio of TCI.

Copyright © Canadian Academy of Oriental and Occidental Culture

There are several methods to calculate the numerator of formula (1). The data of manufacturing sector were used by Lin (2002a) in the study across countries. Lin and Liu (2003) used the data of the secondary sector to analyze the provincial case of China. In this paper, we take the data of industrial enterprises into account. The depreciation rate is 10% according to Lin and Liu (2003) while the investments of the cities are turned into capital stock and the prices are fixed at the 1990 level.

From 1990 to 2009, the TCIs of Changsanjiao, Zhusanjiao and Huanbohai are generally falling. That is to say, in the three regions, the industrial structures are being adjusting according to their endowments.

DEVELOPMENT STRATEGIES AND SPATIAL EFFECTS: EMPIRICAL RESULTS

To reveal how the technical choices and their spatial effects influence the economic growth, we make empirical analysis using spatial penal data model in this section.

The basic forms of the cross-sectional spatial econometric models are spatial autoregression model and spatial error model (see Anselin, 1988, 2001).

The cross-sectional spatial autoregression model is written as

$$(3)\ y = \alpha + \rho Wy + X\beta + \varepsilon$$

where ε has the normal distribution $N[0, \sigma_e^2]$, y is the dependent variable as a N*1 column vector, X the nonconstant explanatory variables as a N*K matrix. W is a N*N matrix which describes the spatial structure with diagonal elements zero. The sample's number is N and the nonconstant explanatory variables' number K. $[\alpha, \rho, \beta', \sigma^2]'$ is the set of parameters to be estimated. ρ is the spatial parameter with the constriction $\rho \in (-1, 1)$.

The cross-sectional spatial error model is written as

$$(4)\quad \begin{aligned} y &= \alpha + X\beta + \varepsilon \\ \varepsilon &= \lambda W\varepsilon + \mu \end{aligned}$$

where μ has the normal distribution $N[0, \sigma_m^2]$, and λ is the spatial parameter with the constriction $\lambda \in (-1, 1)$.

The spatial autoregression model and the spatial error model show different influences of the spatial structures (see Anselin, 2001, 2003). The spatial autoregression model shows that there is spatial substantive dependence, which can be seen clearly from the simplified model of (3) written as

$$(5)\ y = (I - \rho W)^{-1}\alpha + (I - \rho W)^{-1}X\beta + (I - \rho W)^{-1}\varepsilon$$

The spatial influences are transmitted with the matrix $(I - \rho W)^{-1}$, which obviously has an multiplier effect (see Anselin, 2003). Meanwhile, the spatial error model shows that there is spatial nuisance dependence, and the simplified model is

$$(6)\ y = \alpha + X\beta + (I - \lambda W)^{-1}\mu$$

Though the multiplier effect although exists, the spatial structural influence cannot be observed. Therefore, the specification tests are meaningful for different spatial models show different patterns of the spatial effects and the different policies.

The mostly used method for the spatial specification starts from a structural spatial matrix which is given exogenously. Nevertheless, this method often leads to the misuse of the spatial matrix (see Sun, 2009). So we use the nonnested tests given by Sun and Li (2008) to discriminate different matrix representing geographical or economic influences.

Let $W = [w_{ij}]_N$ be an exogenous N*N matrix, where w_{ij} represents the jth sample's influence on the ith sample. The matrix is standardized by row (see Anselin, 1988). In this paper, we use two different spatial matrix, the geographical matrix and the economic matrix. In the geographical case, if the two cities are neighbors, we set $w_{ij} = 1$, otherwise $w_{ij} = 0$. In the economic case, we use the method given by Lin *et al.* (2006), setting $w_{ij} = 1/|\overline{Y}_i - \overline{Y}_j|$, where $\overline{Y}_i$ is the average GDP of the city i. That is to say, in the economic case, the more close the level of economic development, the bigger impact of the spatial effects.

The spatial panel data model used in the empirical analysis is

$$(7)\ \log g_{it} = \alpha_{it} + \beta_{it}\log y_{it} + \gamma_{it}\log DS_{it} + \Psi_i X_{it} + \varepsilon_{it}$$

which is a fixed-effect model. $i \in \{1, 2, 3\}$ represents the Changsanjiao, Zhusanjiao and Huanbohai regions. For the TCI index has a breaking point at 1998 out of the economic data, we use t=1 for 1990-1998 and t=2 for 1998-2009. g_{it} represents the growth rate of the real per-capital GDP. y_{it} is the level of the real GDP at the beginning of the time, that is 1990 and 1998 separately. DS_{it} is given by formula (2) and X_{it} the control variables.

Since $DS_{it} = TCI_{it}/TCI^*$ and TCI^* is unobservable, we use the method given by Lin (2002a) resetting the model as

$$(8)\ \log g_{it} = \eta_{it} + \beta_{it}\log y_{it} + \gamma_{it}\log TCI_{it} + \Psi_i X_{it} + \varepsilon_{it}$$

where $\eta_{it} = \alpha_{it} - \gamma_{it}\log TCI^*$ the fixed-effect.

The control variables which describe the social and economic characters of the region are given by follows:1, the investment rate, using the ratio of the investment and

Copyright © Canadian Academy of Oriental and Occidental Culture

GDP; 2, openness, using the output ratio of the foreign enterprises and the native enterprises; 3, human capital level, using the number of teachers every 100 students; 4, urbanization level; 5, market capacity, using the popularity density every square kilometers; 6, government control, using the proportion of civil servants.

Model (8) is a conditional β -convergence model with control model. Meanwhile, an absolute convergence model is also considered, that is

$$(9)\log g_{it} = \eta_{it} + \beta_{it}\log y_{it} + \varepsilon_{it}$$

and a conditional β -convergence model without control model is also taken into consideration as a contrast.

$$(10)\ \log g_{it} = \eta_{it} + \beta_{it}\log y_{it} + \gamma_{it}\log TCI_{it} + \varepsilon_{it}$$

We first make regressions of model (9) and (10) and the results are shown in table 1 and table 2. We find that the three regions have no absolute β -convergence. Meanwhile, if we only take the technical choices of strategies into account, Changsanjiao and Huanbohai have no β -convergence in 1998-2009, and Zhusanjiao has no β -convergence in 1990-2009.

Table 1
Absolute Convergence Analysis of Model (9)

	Changsanjiao		Zhusanjiao		Huanbohai	
	1998-2009	1990-1998	1998-2009	1990-1998	1998-2009	1990-1998
Initial GDP	0.0043 (0.0792)	0.0054 (0.0761)	0.0547 (1.3288)	-0.0097 (-0.2408)	0.0902 (1.5521)	-0.0916 (-1.2584)
Interception	1.0321	1.0993	0.9134	1.1559	0.7098	1.3704
R2	0.5861					
Adjusted R2	0.5149					

Table 2
Conditional Convergence Analysis with TCI of Model (10)

	Changsanjiao		Zhusanjiao		Huanbohai	
	1998-2009	1990-1998	1998-2009	1990-1998	1998-2009	1990-1998
Initial GDP	0.0088 (0.2415)	-0.1235 (-2.1519)	0.0876 (3.1294)	-0.029 (-0.696)	0.1043 (2.6498)	-0.2091 (-3.8131)
TCI	-0.0755 (-1.233)	-0.1436 (-3.9499)	0.2526 (6.3996)	-0.0412 (-0.6071)	0.1931 (2.2442)	-0.1587 (-4.6503)
Interception	1.0175	1.6066	0.7674	1.2434	0.6415	1.8601
R2	0.8322					
Adjusted R2	0.7831					

Table 3
P-Value of the Specification Tests

p-value	Moran I	Error	Autoregression
Geographical	0.0773	0.6653	0.7359
Economic	0.0511	0.7696	0.018

Copyright © Canadian Academy of Oriental and Occidental Culture

The conditional convergence of model (8) is regressed then. We first make the specification tests of the different spatial structures and the result is given in table 3. On the significance of 10%, we cannot reject the assumption that the growth rate of GDP has economic structure, while cannot reject the assumption that there is geographical structure either. Using the LM test given by Anselin and Florax (1995), in the economic structure model, we reject the assumption of nonexistence of autoregression while cannot reject nonexistence of error effect. Therefore, the economic model is specified as the spatial autoregressive model. In the geographical structure model, we cannot reject the assumption of nonexistence of autoregression, while cannot reject the nonexistence of error effect either. That is to say, if the geographical structure is taken into consideration, the model cannot be specified as spatial error model nor spatial autoregressive model.

The regression model is finally specified as

$$\log g_{it} = \rho W \log g_{it} + \eta_{it} + \beta_{it} \log y_{it} + \gamma_{it} \log TCI_{it} + \Psi_i X_{it} + \varepsilon_{it} \quad (11)$$

where W is the economic spatial matrix. Model (11) is a spatial fixed-effect autoregressive model (see Elhorst, 2003). The method used here is the maximum likelihood estimation and the results are given in table 4.

With the nonnested test of Sun & Li (2008), the estimation errors of model (11) are tested using the geographical matrix and resulting the p-value 0.2502, which tells us that, once the economic structure is taken into consideration, the geographical effect is no longer significant. That is to say, the information of the geographical structure is contained in the economic structure.

Table 4
Regression Results of Model (12)

		1998-2009		1990-1998	
Interception	Changsanjiao	0.846	(4.727)	1.481	(7.027)
	Zhusanjiao	0.473	(2.644)	0.939	(4.878)
	Huanbohai	0.449	(2.611)	1.561	(7.501)
Initial GDP	Changsanjiao	-0.023	(-0.669)	-0.179	(-3.457)
	Zhusanjiao	0.075	(1.760)	-0.035	(-0.907)
	Huanbohai	0.079	(1.948)	-0.209	(-4.245)
TCI	Changsanjiao	-0.089	(-1.693)	-0.142	(-4.982)
	Zhusanjiao	0.257	(7.317)	-0.039	(-0.654)
	Huanbohai	0.201	(2.800)	-0.144	(-4.173)
Investment ratio		-0.073		(-1.436)	
Openness		0.007		(3.214)	
Human capital		0.068		(1.026)	
Urbanization		0.029		(0.867)	
Market capacity		-0.002		(-0.089)	
Government control		-0.980		(-0.980)	
Spatial parameter		0.330		(3.002)	
R2		0.869			
Adjusted R2		0.811			
Likelihood function		219.086			

The empirical analysis leads us to the following results:

(I) In the empirical model the three regions show economic spatial effects, and the spatial structure is autoregressive. The spatial effects have positive parameters shows that, the cities which have faster economic development will make positive influences on the neighboring cities. The autoregressive structure implies a multiplier effect, that is to say, the positive spatial influences will widely spread across cities close to each other.

(II) The economic structure rather than the geographical structure implies that the cities with economic development levels similar to each other have some kind of imitating effect, which shows the healthy competition across cities exist in the regions.

(III) The conditional β-convergence only exists in Huanbohai and Changsanjiao during 1990-1998. The economic growth has some kind of negative relationship with the TCIs when the convergence happens, which

Copyright © Canadian Academy of Oriental and Occidental Culture

supports Lin's views, that is, the adjustment of the industrial structure according to the endowments is an important reason to make the convergence happen.

(IV) Only the openness of all the control variables is significant, which implies that in the regions, the cities' characters are similar to each other. This leads to the conclusion that out of the similarity, the characters cannot give a convincible explanation about the difference of growth ratio, which meets the view of Magrini (2004).

CONCLUSIONS

Spatial panel data model is used in this paper for the analysis of Changsanjiao, Zhusanjiao and Huanbohai regions about the topic of economic convergence and the spatial effect, while the different choices of industrial strategies will significantly influence whether the convergence happens.

Empirical results show that the conditional β-convergence happens in Changsanjiao and Huanbohai during 1990-1998. The adjustment of the industrial strategies represented by the TCI gives an important explanation about the convergence. Meanwhile, in each region, there is significant spatial effect between the cities. The spatial effect is constituted by kind of economic structure to motivate healthy competition and there is multiplier effect to make the influences spread across cities.

Two policy suggestions are given according to the analysis. First, to reduce the growth gap between the cities, the industrial strategies should be adjusted according to the endowments to make the convergence happen. Second, the Changsanjiao, Zhusanjiao and Huanbohai regions have significant economic spatial effects. Encouraging healthy competition between the cities at the similar level of economic development will make better use of the spatial effect.

REFERENCES

Anselin, L. (1988). S*patial Econometrics: Methods and Models*. Kluwer Academic: Dordrecht, the Netherlands.

Anselin, L. (2001). Spatial Econometrics. In B. Baltagi (Ed.), *A Companion to Theoretical Econometrics* (pp. 310-30). Blackwell Scientific: Oxford, UK.

Anselin, L. (2003). Spatial Externalities, Spatial Multiplier, and Spatial Econometrics. *International Regional Science Review 26*(2), 153-166.

Anselin, L. & Florax, R. (1995). Small Sample Properties of Tests for Spatial Dependence in Regression Models: Some Further Results. In L. Anselin & R. Florax (Ed.), N*ew Directions in Spatial Econometrics* (pp. 21-74). Berlin: Springer-Verlag.

Cai, F. & Du, Y. (2000). Convergence of the Regional Economic Development: Policy Suggestions to the West Development Strategies. *Economic Research Journal*, (10).

Elhorst, J. (2003). Specification and Estimation of Spatial Panel Data Models. *International Regional Science Review*, *26*(3), 244-268.

Fan, J. & Zhang, T. (2003). Adjustment of Structure and Regional Convergence: Experiences from U.S.. *The Journal of World Economy*, (1).

Lin, G., Long, Z. & Wu, M. (2005). Regional Economic Convergence: A Spatial Econometric Analysis (1978-2002). *China Economic Quarterly*, (4).

Lin, G., Long, Z. & Wu, M. (2006). A Spatial Econometric Analysis of the σ Convergence in China. *The Journal of Quantitative & Technical Economics*, (4).

Lin, Y. (2002a). Development Strategies, Viability and Economic Convergence. *China Economic Quarterly*, *1*(2).

Lin, Y. (2002b). Viability, Economic Transition and the Reflection of Neoclassic Economy. *Economic Research Journal*, (12).

Lin, Y. & Liu, M. (2003). China's Economic Convergence and the Distribution of Income. *The Journal of World Economy*, (8).

Lin, Y. & Liu, P. (2003). Economic Development Strategies and the Difference of Income between Provinces in China. *Economic Research Journal*, (3).

Liu, M., Wei, Y. & Li, G. (2004). Convergence or Divergence: A Review on the Regional Economic Development in China. *Economic Research Journal*, (7).

Liu, Q. (2001). A convergence analysis about China's Economic Growth. *Economic Research Journal*, (6).

Magrini, S. (2004). Regional (di) Convergence. In V. Henderson & J. F. Thisse (Ed.), *Handbook of Regional and Urban Economics* (Vol. 4). New York: Elsevier.

Peng, G. (2005). Difference of the Provincial Incomes, Productivity and the Convergence. *Economic Research Journal*, (9).

Sun, Y. (2009). The Misuse of the Spatial Matrix in Spatial Econometric Models. *Statistical Research*, (6).

Sun, Y. & Li, Z. (2008). A Nonnested Test for the Specification of Spatial Matrix. *The Journal of Quantitative & Technical Economics*, (7).

Wu, Y. (2006). A Spatial Econometric Analysis about the Provincial Economic Growth in China. The *Journal of Quantitative & Technical Economics*, (12).

Copyright © Canadian Academy of Oriental and Occidental Culture