

Study on credit expansion to coordinated development of Urban agglomeration economy

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Abstract. According to the growth pole theory, financial agglomeration has an important impact on economic growth and coordinated development of regional economy. How to realize regional coordinated development through optimal allocation of factors of production has become an important problem in regional economics in the new era. Based on the urban agglomeration mentioned in the "14th Five-Year Plan", this paper firstly evaluates the coordinated development of regional economy, and then studies the spatial effect of credit expansion, discusses the factors influencing the backflow effect and diffusion effect of credit expansion, so as to put forward policy suggestions for the coordinated development of financial support.

Keywords: Urban agglomeration; Credit expansion; Regional coordinated; development; Spatial autoregressive model

1. Introduction

Since the reform and opening up, with the rapid growth of China's economy, the phenomenon of uncoordinated regional development has become increasingly serious. In the 14th Five-year Plan, the CPC Central Committee and The State Council proposed to "develop and strengthen urban agglomerations and metropolitan circles, guide the development direction and construction priorities of large, medium and small cities by classification, and form a spatial pattern of urbanization with good density, division of labor and cooperation and complete functions." We will focus on building high-quality city clusters to promote coordinated development of regional economies. As the core of modern economy, finance plays an important guiding and regulating role in optimizing the allocation of regional resources and promoting the coordinated development of regional economy. Bank credit is the main component of China's financial system, and the scale of credit investment has an important impact on the play of financial functions. This paper selects four relatively mature urban agglomerations -- Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta (Guangdong-Hong Kong-Macao Greater Bay Area) and Chengdu-Chongqing, and uses Moran index to characterize the differences of regional economic development levels. On the basis of relevant empirical research, this paper will analyze the regional credit input, economic development gap and their correlation, further explore how credit input affects the development degree of urban agglomeration, in order to better understand the law of macroeconomic operation, and provide beneficial policy suggestions for the coordinated development of regional economy and finance in the future.

2. Related work

The effect of credit expansion on economic development can not be underestimated. In terms of theoretical research, Schumpeter (1934) [1] proposed in *The Theory of Economic Development* that entrepreneurs can become entrepreneurs only when they become debtors first. The credit provided by banks to entrepreneurs enables them to acquire purchasing power for investment and production. Goldsmith (1969) [2] proposed the theory of financial structure and believed that the promotion of finance to economic development came from the rearrangement of capital supply and demand of savers and investors by financial institutions. Levine & Zervos (1998) [3] showed that there was a significant long-term positive relationship between financial development and economic growth. Lin Yifu (2009) [4] proposed the theory of optimal financial structure, emphasizing that financial institutions have their own optimal financial structures in different stages based on the

different industrial characteristics of the real economy. Myrdal (1957) [5] put forward the theory of "accumulation cyclic causality", believing that "agglomeration" promotes the formation of growth centers through the scale effect of information and technology, and the growth momentum of this center will have a diffusion effect on other regions. Limited by the size of the local market, financial centers are forced to provide financial services to the surrounding areas, thus bringing spillover effect of financial agglomeration.

In terms of empirical research, there are many researches on regional heterogeneity and growth mechanism of credit on economic growth. The existing research results on the interaction between credit and regional economic development mainly focus on the following directions: In the area of regional influence mechanism on financial agglomeration. Xie Yang (2016) [6] believed that coordinated development capacity and integrated development level of urban agglomerations have become important mechanism variables affecting financial agglomeration capacity of urban agglomerations, and the development level of urban agglomerations has a significant role in promoting financial agglomeration. Huang Yongxing (2014) [7] believes that urban agglomeration infrastructure and economic scale both promote the formation of financial agglomeration. In the field of the impact of financial agglomeration on regional development, Zhang Jun (2014) [8] conducted co-integration test and causal relationship test on the data of Shandong province from 1978 to 2013, and the results showed that there was a long-term stable relationship between credit growth and economic growth in Shandong Province, and credit was the Granger cause of economic growth. Zheng Zhidan (2016) [9] made a comparative study of the economic data of Beijing-Tianjin-Hebei region and The Yangtze River Delta from 2000 to 2014, and found that the spillover effect of financial aggregation in the Yangtze River Delta promoted the economic growth of neighboring regions, while the financial aggregation in The Beijing-Tianjin-Hebei region led to the serious loss of financial resources in Hebei, which was not conducive to economic growth. Ni Jinfeng (2022) [10]

Existing literatures mainly have the following three characteristics: (1) from the perspective of research objects, most literatures study the effect of credit expansion on economic growth and the effect of regional characteristics on financial agglomeration, while few literatures focus on the influence mechanism of credit expansion on the coordinated development of regional economy. (2) From the perspective of research methods, the following two research methods are adopted in most literatures: ① Time series data are selected to establish VAR model and granger causality test is conducted. ② Select panel data to build panel regression model. The commonly used estimation methods are tool variable estimation method and System GMM estimation method. (3) From the research conclusion, the existing literature basically believes that credit expansion can promote economic growth. However, in terms of the effect of credit expansion on the coordinated development of regional economy, different researches have some differences, mainly including the following two viewpoints: (1) The diffusion effect of credit expansion plays a dominant role and can promote the coordinated development of regional economy. (2) The backflow effect is more significant, and the regional credit difference will lead to the widening of regional economic development gap.

At the same time, the existing literature, there are the following content: (1) most of the research on perfecting the only attention to the overall relationship between credit and economy, the lack of analysis on the regional differences of the two relationships, little account of the differences of regional credit on economic growth of spillover effect and competition effect, study the credit relationship with regional economic coordinated development of the literature. (2) Many research results focus on the impact of the development of the entire financial system on economic growth, but few involve the impact of credit development on the economy of urban agglomeration.

On the basis of absorbing the positive factors of existing studies and improving their shortcomings, this paper intends to build a panel model based on the data of each city in the four major urban agglomerations from 2004 to 2014 to conduct an empirical analysis on the relationship between credit input and regional economic growth and regional coordinated development.

3. Theoretical framework and model construction

3.1 Model Construction

In order to measure the relationship between economic development level and spatial correlation, this paper introduces the global Moran 'i coefficient for evaluation, and its formula is as follows:

$$I = \frac{n}{\sum_{i=1}^n \sum_{j=1}^n w_{ji}} \times \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (1)$$

Where, n is the number of regions; Variables X_i and X_j respectively represent the per capita GDP of region I and region J in a fixed year. w_{ij} is the spatial adjacency weight matrix of region I and region J. In this paper, binary space adjacency matrix is used, where 1 indicates that region I is adjacent to region J, and 0 indicates that region I is not adjacent to region J. When Moran's I is between -1 and 1, and Moran's $I > 0$, it indicates strong regional economic connection. When Moran's $I < 0$, it indicates that regional economic connection is weak.

In addition, in order to further evaluate the externality effect and backflow effect of credit expansion, this paper chooses spatial autocorrelation model (SARAS) model to conduct spatial empirical analysis. SARAS model is the general case of spatial error model (SEM) and spatial autoregression model (SAR). When the conditions are not met, The SARAS model (i.e. SARAS(1,1)) is automatically degraded to SEM model (i.e. SARAS(0,1)) and SAR model (i.e. SARAS(1,0)), which ADAPTS to the data characteristics used in this paper.

The general model construction of SARAS (1,1) is as follows:

$$\begin{cases} y_{it} = \rho w'_{it} y_t + x'_{it} \beta + u_i + \gamma_t + \varepsilon_{it} \\ \varepsilon_{it} = \lambda m'_{it} \varepsilon_t + v_{it} \end{cases} \quad (2)$$

Where, ρ is the spatial error coefficient, w' is the first row of the spatial weight matrix, $w'_{it} y_t = \sum_{j=1}^n w_{ij} y_{jt}$ and is the (i,j) elements of the spatial weight matrix. β is the corresponding explanatory variable, β is the corresponding coefficient, u_i is the individual effect of region i, γ_t is the time effect, λ is the spatial autoregression coefficient, m'_{it} is the i-th row of the space matrix M of the disturbance term.

W and M are the spatial weight matrices of explained variable Y and disturbed term u respectively, and they can be equal. In this paper, the geographical adjacent spatial weight matrix is adopted. W is $N \times N$ spatial matrix, where N is the number of regions in the data. In the spatial model, the diagonal element of the W matrix is zero. The W matrix is 1 for adjacent and 0 for non-adjacent. Such as $w_{ij} \neq 0$, means that the jth region is geographically adjacent to the ith region, and when $w_{ij} = 0$, the jth region is not adjacent to the ith region.

3.2 Variable Selection

The samples selected in this paper are shown in Table 1. The dependent variable is the per capita GDP of each city, the independent variable is the per capita loan balance of each city, and the control variable refers to the variables involved by Wen Tao (2018) [13]. Variables are described in Table 2.

Table 1. List of major urban agglomerations

Urban Agglomeration name	Contains city
Yangtze River Delta Urban Agglomeration (YRD)	Shanghai, Nanjing, Wuxi, Changzhou, Suzhou, Nantong, Yancheng, Yangzhou, Zhenjiang, Taizhou, Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Jinhua, Zhoushan, Taizhou, Hefei, Wuhu, Ma 'anshan, Tongling, Anqing, Chuzhou, Chizhou, Xuancheng
Guangdong-hong Kong-Macao Greater Bay Area (PRD)	Hong Kong, Macau, Guangzhou, Shenzhen, Foshan, Dongguan, Zhongshan, Zhuhai, Jiangmen, Zhaoqing, Huizhou
Beijing-tianjin-hebei City Cluster (B-T-H)	Beijing, Tianjin, Shijiazhuang, Tangshan, Baoding, Qinhuangdao, Langfang, Cangzhou, Chengde, Zhangjiakou
Chengdu-chongqing Urban Agglomeration (C-C)	Chengdu, Chongqing, Zigong, Luzhou, Deyang, Suining, Neijiang, Leshan, Nanchong, Meishan, Yibin, Guang 'an, Ziyang

Source: Opinions of the CPC Central Committee and The State Council on establishing a More effective new mechanism for Coordinated Regional Development

Table 2. Variable description

Variable types	The variable name	Variable declaration
The dependent variable	GDP	Per capita GDP of each city
The independent variables	credit	Each city per capita loan balance
	finance	Per capita expenditure in the general public budget of each municipality
Control variables	FIX	Each city per capita fixed asset investment
	ROAD	Each city that year freight volume
	COSUMER	Each city per capita social retail commodity amount

Source: Provincial statistical yearbooks, EPS database

4. Empirical results

4.1 Descriptive statistics of regional economic development differences

In order to measure the differences in economic development levels among regions, this paper adopts the variation coefficient method proposed by Liu Yanhua (2015) [14] to measure the differences in regional development levels of the four major urban agglomerations during 2004-2014, and the results are shown in the figure below:

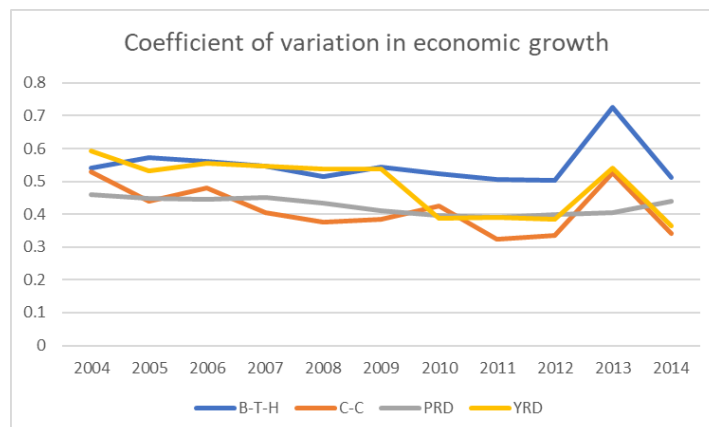


Figure 1. Per capita GDP Difference Coefficient of the four Major urban agglomerations (2004-2014)

As can be seen from the figure, the regional economic development of Beijing-Tianjin-Hebei region differs greatly, while that of the Yangtze River Delta, Pearl River Delta and Chengdu-Chongqing urban agglomeration differs little. Among them, the rapid narrowing of the regional economic development gap in the Yangtze River Delta in 2008 May be related to the relatively slow economic growth of Shanghai and the relatively higher growth of regional sub-centers such as Nanjing and Hangzhou. In 2013, the Beijing-Tianjin-Hebei, the Pearl River Delta, Yangtze River Delta regional economic development difference expanded rapidly, and a return to the initial level in 2014, it is assumed that may be related to "the central committee of the communist party of China about certain major issue decision" comprehensively deepen reform through relevant, Beijing, Shanghai, Guangzhou and Shenzhen as the first-tier cities, to undertake the more policy pilot, dividend policy in the current release. With the expansion of the pilot cities, other cities also benefited from the policy reform, thus narrowing regional economic disparities in the second year.

4.2 Moran index results

Moran's coefficient of per capita GDP of the four major urban agglomerations from 2004 to 2014 is calculated, and the results are shown in Table 3.

Table 3. Moran coefficient results

year	chengdu-chongqing	Yangtze delta	river The delta	pearl river	beijing-tianjin-hebei
2004	0.12	0.16 **		0.45 ***	0.17
2005	0.08	0.15 **		0.45 ***	0.14
2006	0.08	0.16 **		0.44 ***	0.13
2007	0.06	0.15 **		0.45 ***	0.15
2008	0.07	0.14 **		0.45 ***	0.14
2009	0.10	0.17 ***		0.47 ***	0.12
2010	0.13	0.14 **		0.50 ***	0.09
2011	0.16	0.30 ***		0.52 ***	0.08
2012	0.17	0.33 ***		0.53 ***	0.08
2013	0.14	0.24 ***		0.53 ***	0.10
2014	0.17	0.38 ***		0.47 ***	0.10

Standard errors in parentheses

* $P < 0.1$, ** $P < 0.05$, *** $P < 0.01$

As can be seen from the table, the Moran coefficient of the Yangtze River Delta and Pearl River Delta is significantly positive, indicating strong spatial correlation of economic development and

relatively mature urban agglomeration development. However, in the sample period, Chengdu-Chongqing urban agglomeration is still in its early stage of development, and the Beijing-Tianjin-Hebei integrated development framework has not yet emerged, so the Moran coefficient of these two regions shows an insignificant negative number. In addition, due to the unique bipolar development mode of Chengdu-Chongqing urban agglomeration, the two regional economic growth poles of Chengdu and Chongqing are located at the east and west sides of the urban agglomeration respectively in geographical space, and the spatial agglomeration is not obvious, and there is a certain competition relationship (Chen Minghua, 2016). From the perspective of time, the Moran coefficient of per capita GDP in the Yangtze River Delta increased significantly after 2011. The Moran's coefficient of per capita GDP in the Pearl River Delta keeps around 0.5 all the year round, indicating that the Yangtze River Delta and the Pearl River Delta have a high level of spatial agglomeration. Therefore, this paper defines the Yangtze River Delta and the Pearl River Delta as "mature urban agglomerations", while the Beijing-Tianjin-Hebei and Chengdu-Chongqing regions are defined as "relatively mature urban agglomerations".

In order to further study the spatial aggregation of the Yangtze River Delta and Pearl River Delta, this paper measured and plotted the local Moran index of both regions in 2014, and the results are shown in Figure 2.

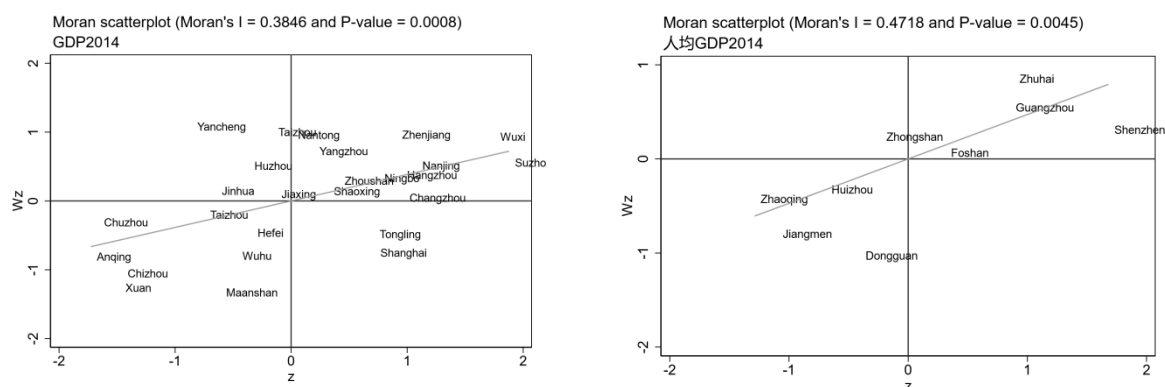


Figure 2. Local Moran coefficient scatter diagram of Yangtze River Delta (left) and Pearl River Delta (right) in 2014

As can be seen from the figure, in the Yangtze River Delta, southern Jiangsu province and northern Zhejiang province show high HH, that is, the Moran index itself is high and other surrounding areas are also high. In the Pearl River Delta, the cities in its core region are also located in the first quadrant. In summary, it can be found that the core areas of developed urban agglomerations have a higher degree of spatial agglomeration.

4.3 Results of spatial autocorrelation model

This paper uses spatial autoregressive model (SARAS) to estimate the backflow effect and outward expansion effect of credit growth, and the specific model is as follows:

$$\ln GDP_{i,t} = \alpha + \beta_1 \ln credit_{i,t} + \varphi_2 \ln consumer_{i,t} + \varphi_3 ROAD_{i,t} + \varphi_4 \ln finance_{i,t} + \varphi_5 \ln fix_{i,t} + \varepsilon_{i,t}, i = 1, 2, \dots, n; t = 1, 2, \dots, m \quad (3)$$

According to The Hausmann test, the four major urban agglomerations all have fixed effect, so the spatial fixed panel is used for regression. The regression results are as follows. In order to save space, only direct and indirect effects of credit are reported. The results are shown in Table 4.

Table 4. Regression results of spatial autocorrelation model

lnGDP	chengdu- chongqing	Yangtze delta	riverThe delta	pearl riverbeijing-tianjin- hebei
Main				
lncredit	0.0854 * *	0.0992 * *	0.308 * * *	0.0993 * *
lnfinance	0.0614	0.449 * * *	0.333 * * *	0.0828
lnconsumer	0.0796	0.474 * * *	0.0637	0.317 *
lnfix	0.0751 *	0.0836 *	0.00515	0.133 * * *
ROAD	0.00172	0.000479	0.0347 * *	0.00029
LR_Direct				
lncredit	0.0863 * *	0.101 * *	0.310 * * *	0.108 * *
LR_Indirect				
lncredit	0.0217	0.01	0.00259	0.0404 *
LR_Total				
lncredit	0.0645 * *	0.111 * *	0.313 * * *	0.0679 *
lnfinance	0.0488	0.490 * * *	0.337 * * *	0.0526
lnconsumer	0.0712	0.511 * * *	0.0671	0.223 * *
lnfix	0.0570 *	0.0903 *	0.00514	0.0885 * * *
ROAD	0.0013	0.000539	0.0339 * *	0.00022

Standard errors in parentheses

* P <0.1, ** P <0.05, *** P <0.01

LR_Direct represents the influence of this variable on the per capita GDP growth in this region, while LR_Indirect represents the influence of this variable on the per capita GDP growth in adjacent regions, and LR_Total represents the total influence of this variable on the per capita GDP growth. From the above results, the core variable LNCREDIT of Beijing-Tianjin-Hebei and Yangtze River Delta is positive and significant at 5% level, and the core variable of Pearl River Delta is positive and significant at 1% level. However, the core variables of chengdu-Chongqing urban agglomeration are negative and significant at 5% level. In terms of direct effect, credit growth has a significant positive impact on economic growth in the Yangtze River Delta region and Beijing-Tianjin-Hebei Region, and the coefficient is similar, about 0.1. The coefficient of pearl River Delta urban agglomeration is about 0.3, which is significant at 1% level, indicating that credit expansion plays a strong role in improving per capita GDP. And chengdu-Chongqing urban agglomeration is negative. In terms of indirect effects, the coefficients of Chengdu-Chongqing, Yangtze River Delta and Pearl River Delta are not significant, while the beijing-Tianjin-Hebei coefficient is significantly negative at the level of 10%, indicating that in the sample period, the beijing-Tianjin-Hebei urban agglomeration has a strong polarization effect of credit expansion, which to some extent explains the formation of "Beijing-tianjin-Hebei poverty circle".

5. Conclusions and policy recommendations

To sum up, from the perspective of regional economic coordination level, the development gap between Beijing, Tianjin and Hebei is large; In terms of spatial correlation level of economic development, the Yangtze River Delta and the Pearl River Delta are highly correlated, indicating that the Yangtze River Delta and the Pearl River Delta have a high degree of regional integration and close economic ties. From the perspective of the spatial effect of credit growth, The beijing-Tianjin-Hebei region presents a relatively obvious polarization effect, and the credit expansion expands the difference of regional economic level, while the credit spatial effect of Chengdu-Chongqing, Yangtze River Delta and Pearl River Delta is not significant.

The policy suggestions are as follows : (1) maintain reasonable credit expansion and actively promote economic growth. The expansion of bank credit scale can bring sufficient development funds

to the region, so as to promote the construction of regional infrastructure, the development of industry, the introduction of high-quality talents, and so on, and thus have a positive impact on economic growth.(2) Establish and improve the regional coordinated development mechanism, smooth the free flow of various factors of production within the region, and guide the rational allocation of credit among cities.

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