An Empirical Analysis on the Influence of Urban Agglomeration Diversification on Economic Growth

Didi Wu[1, 2, a*], Jie Gao[3,b] and Shuangqiang Li[1,c]

[1] School of Economics, Sichuan University, Chengdu, China

[2] Chengdu Institute of Administration, Chengdu, China

[3] Sichuan Academy of Social Sciences, Chengdu, China

[a,*]wudidi@foxmail.com, [b]7390477@qq.com, [c]754953087@qq.com

Keywords: Urban Agglomeration; Diversification; Related Variety; Unrelated Variety; Economic Growth

Abstract: Diversified agglomeration has different growth effects. In order to explore the impact of related and unrelated variety on economic growth, this paper takes 15 major urban agglomerations in China as research objects to conduct empirical research by adopting threshold regression and using panel data from 2003 to 2015. The results show that after the size of the urban agglomeration and the level of economic development exceed a certain threshold, the negative correlation between unrelated variety and economic growth will weaken. Related variety has a significant role in promoting the economic growth of urban agglomerations only when the economic development level is in a specific range.

Introduction

Agglomeration, manifested as the high agglomeration of population and economic activities in specific spatial areas, is one of the remarkable characteristics highlighted in the development of the current economy around the world, while urban agglomeration is an advanced spatial form of agglomeration mapping in geographical space, as the result of industrialization and urbanization. At the global level, world-class urban agglomerations situate at the top of the global-urban-system pyramid with its highly agglomerated economic characteristics, dominating the economic development pattern of their countries and even the whole world.

As a major developing country, China has witnessed accelerated forging ahead in industrialization and urbanization in the past 40 years since the reform and opening up, during which urban agglomeration has grown up to an essential agglomeration space for the highly concentrated economy in China step by step. In 2015, 15 urban agglomerations in China accommodated nearly half of the country's population and generated more than 70% of the total economy in less than one-sixth of the country's land area. With the urbanization rate of over 58%, China has surpassed the average world level and shall remain this momentum of rapid urbanization in the future based on the law of urbanization. As a space carrier of high efficiency and intensive development loading most urban population, urban agglomeration has become a critical carrier in the period of rapid urbanization in China, enabling itself as the core regional space of China's economic development with its highly concentrated economic elements and activities.

According to whether the agglomeration effect comes from the same industry, the agglomeration can be divided into specialized agglomeration and diversified agglomeration. Specialized agglomeration facilitates the sharing of infrastructure, labor markets and intermediate product markets, reduces production and transaction costs, promotes knowledge and information spillovers among enterprises within the industry, and promotes competition among enterprises, thus increasing the efficiency of growth. Diversified agglomeration is conducive to coping with the changeable demand market, reducing the search cost, promoting the birth of new products and new technologies, leading to increasing returns, which result in increasing revenue and economic

growth. Specialization and diversification are not opposites. Large cities often have a number of highly specialized industries at the same time, which is characterized by diversified agglomeration. In the urban system described by Duranton and Puga (1999), the mixed urban system includes both specialized cities and diversified cities. They believe that new products tend to exist in diversified cities, and when the production technology is mature, mass production tends to be distributed in specialized cities, so that the urban system gradually develops into an equilibrium state.

Urban agglomeration is such a mixed urban system, which consists of a series of cities with different scales and functions. Generally speaking, the central city has a large scale, strong comprehensive urban functions and significant industrial diversification and agglomeration characteristics. Other cities have a certain level of specialization in different industries, and there may be a certain division of labor and cooperation between them and the central cities. If the urban agglomeration area is regarded as a whole unit, even if there are some industries with a higher level of specialization, it will eventually show more obvious characteristics of diversified agglomeration in the overall urban agglomeration area. Therefore, this paper will focus on the diversified agglomeration of urban agglomeration and study the relationship between its diversified agglomeration and economic growth.

Technology is an important factor in the theory of economic growth. The diversification agglomeration of urban agglomeration can be divided into irrelevant diversification and related diversification by introducing technology correlation (Frenken et al, 2007).

Related diversification is also called related variety (RV), which refers to the industrial agglomeration of a series of different types within a certain region with strong economic and technological ties among industries. First of all, related diversified agglomeration is conducive to promoting enterprise innovation. The dynamic externality theory proves that knowledge exchange between complementary industries can stimulate the generation and diffusion of new knowledge, thus promoting productivity improvement and economic growth. Secondly, the relevant diversified agglomeration can also reduce the cost of talents and investment by sharing and maintaining the labor market and investment support of knowledge and technology, thus having a positive impact on innovation and economic growth.

Unrelated diversification or unrelated variety (UV) refers to the agglomeration of different industries without obvious knowledge or technology connection in a particular area. Most studies believe that unrelated variety reduces the opportunities of knowledge reorganization and creation due to the far distance between industries, and knowledge spillover and its promoting effect on innovation are difficult to realize. But on the other hand, unrelated variety can still promote economic growth by sharing labor, intermediate products and technologies to promote matching and reduce search costs. Once unrelated variety brings cross-industry innovation and technology connection, the new production mode or application brought by innovation will give birth to new industries and other path breakthroughs will be achieved (Castaldi et al, 2014). So unrelated variety may have a negative correlation with economic growth, but there is also an opportunity to catalyze cross-sectoral technological innovation to break out of the original development path.

Related variety and unrelated variety also have the portfolio effect. Unrelated variety can disperse and reduce the impact of external economic changes, while related variety may fall into short-term production and employment difficulties due to the chain reaction of related industries (Frenken et al, 2007).

In general, the larger the size of the urban agglomeration and the higher the level of economic development, the more mature the urban agglomeration will be. For more mature urban agglomerations, unrelated variety is more likely to lead to technological innovation and path breakthrough, while related diversified agglomeration may face the emergence of agglomeration diseconomy more quickly. Therefore, unrelated and related diversification of urban agglomeration with different development degrees may have different growth effects. The relationship between them is likely to be non-linear. So this paper will adopt the method of threshold regression to conduct empirical research on the relationship between diversification and economic growth in China's 15 urban agglomerations.

Method

According to previous research and empirical evidences this study gauges a panel threshold regression model by Hansen (1999) to find the relationship between related variety, unrelated variety and economic growth of urban agglomeration in China.

$$y_{it} = u_i + \beta_1^{'} x_{it} \cdot \mathrm{I}(q_{it} \le \gamma) + \beta_2^{'} x_{it} \cdot \mathrm{I}(q_{it} > \gamma) + \varepsilon_{it} \tag{1}$$

The panel threshold model herein can be expressed by

$$\ln Pgdp_{it} = \beta_0 + \beta_1^{'} \ln RV_{it} \cdot \mathrm{I}(q_{it} \le \gamma) + \beta_2^{'} \ln RV_{it} \cdot \mathrm{I}(q_{it} > \gamma) + \beta X_{it} + \mu_{it} + \varepsilon \tag{2}$$

and

$$\ln Pgdp_{it} = \beta_0 + \beta_1^{'} \ln UV_{it} \cdot \mathrm{I}(q_{it} \le \gamma) + \beta_2^{'} \ln UV_{it} \cdot \mathrm{I}(q_{it} > \gamma) + \beta X_{it} + \mu_{it} + \varepsilon \tag{3}$$

In which $Pgdp_{it}$ is the GDP per capita in the t-th year of the urban agglomeration. RV_{it} and UV_{it} represent the related and unrelated variety in the t-th year of the city group, respectively. X_{it} indicates a series of control variables, μ_{it} is the intercept term, and ε is the random interference term. *RV* and *UV* values are calculated according to Frenken's (2007) method.

The relationship between diversification and economic growth of urban agglomerations may be different due to the influence of population size, industrial characteristics and development level. So the total urban population of urban agglomeration (*POP*) is taken as the threshold variable, which can directly reflect the density of agglomeration factors, the size of market scale, and the maturity of urban agglomeration development. GDP per capita (*Pgdp*) is taken as the other threshold variable to measure the economic development level and development degree of urban agglomeration. In addition, government fiscal expenditure (*Fe)*, fixed asset investment (*Invest)*, infrastructure level (*inf*), per capita wages (*Wage*), population density (*PD*) are used as control variables.

Data Set

China currently has 15 recognized urban agglomerations. Each urban agglomeration has a series of cities. All the data about cities is taken from city statistics yearbooks of China from 2003-2015. The relevant data of urban agglomeration can be obtained through simple operations such as the sum of the city data.

Results

The two variables of urban agglomeration population and economic development level are selected as the threshold. Based on the employed threshold model, the corresponding results of threshold value (γ) are listed in following table.

Table 1. Results of threshold value

Threshold variable	Independent variable	Threshold estimate		Confidence interval
Urban agglomeration population size	ln*UV*	γ_1	746	[708,774]
		γ_2	3820	[3704,3864]
Economic development level	ln*RV*	γ_1	10.27	[10.18,10.28]
		γ_2	11.93	[11.80,11.99]
	ln*UV*	γ_1	9.67	[9.569,9.724]
		γ_2	10.62	[10.53,10.71]

According to the threshold value calculated, the estimated results taking population size and economic development level of urban agglomeration as threshold variables are shown in table 2.

Table 2. Estimated results

Variable	Model(1)	Model(2)	Model(3)
	Urban agglomeration population	Economic development level	
	ln*Pgdp*	ln*Pgdp*	ln*Pgdp*
ln$RV(th<\gamma_1)$		0.139	
		(0.421)	
ln$RV(\gamma_1< th<\gamma_2)$		4.126***	
		(0.477)	
ln$RV(th>\gamma_2)$		-0.00758	
		(0.619)	
ln$UV(th<\gamma_1)$	-1.260*		-5.284***
	(0.705)		(0.546)
ln$UV(\gamma_1< th<\gamma_2)$	-4.173***		-3.240***
	(0.535)		(0.471)
ln$UV(th>\gamma_2)$	-1.364**		-1.542***
	(0.589)		(0.485)
Fe	-4.724***	-3.571***	-2.098**
	(0.957)	(0.924)	(0.892)
Invest	0.294*	0.217	0.144
	(0.150)	(0.150)	(0.135)
Inf	0.159***	0.118***	0.0884***
	(0.00939)	(0.0111)	(0.0108)
ln*Wage*	0.0270	0.0662***	0.0576***
	(0.0206)	(0.0205)	(0.0183)
ln*PD*	0.194*	0.150	0.177*
	(0.112)	(0.114)	(0.101)
C	8.071***	7.445***	7.794***
	(0.852)	(0.797)	(0.751)
Obs	195	195	195
R-sq	0.837	0.830	0.867
N	15	15	15

Note: ***=significant at 1% level, **=significant at 5% level. Figures in parenthesis are standard deviation.

When population size of urban agglomeration is taken as threshold variable, only *UV* has a double threshold effect on economic growth of urban agglomeration. From the results of model (1), *UV* and economic growth have different degrees of negative relationship under different population size. When the population is less than 7.46 million, the negative effect of *UV* on economic growth of urban agglomerations is the smallest, with a regression coefficient of -1.260. When the population is in the range of 7.46 to 38.2 million, the negative correlation is most significant and the regression coefficient is -4.173. When the population exceeds 38.2 million, the negative correlation coefficient weakens to -1.364.

When the level of economic development of urban agglomerations is taken as the threshold variable, both *UV* and *RV* have double threshold effects on the economic growth of urban agglomerations. The negative correlation between *UV* and economic growth has gradually weakened with the improvement of economic development level. Only when the per capita GDP of the urban agglomeration is between 28,900 and 151,800 Yuan, *RV* has a significant promotion effect on the economic growth of the urban agglomeration, and its correlation coefficient is 4.126.

Conclusion

According to the method of Frenken et al (2007), the agglomeration of urban agglomerations is decomposed into related and unrelated variety. The results of empirical research on Chinese urban agglomerations show that unrelated variety has a negative correlation with economic growth of urban agglomerations in most instances. After the size of the urban agglomeration and the level of economic development exceed a certain threshold, the negative correlation between unrelated variety and economic growth will weaken. Related variety has a significant role in promoting the economic growth of urban agglomerations only when the economic development level is in a specific range.

In reality, at present the economic development level of China's urban agglomerations have been in a low negative correlation between unrelated variety and economic growth. Except the Yangtze River delta and the Pearl River delta, the related variety of other urban agglomerations still promotes economic growth.

References

[1] Duranton G, Puga D. Diversity and Specialisation in Cities: Why, Where and When Does it Matter?[J]. Urban Studies, 1999, 37(3):533-555.

[2] Henderson J V. Efficiency of resource usage and city size[J]. Journal of Urban Economics, 1986, 19(1):47-70.

[3] Castaldi C, Frenken K, Los B. Related Variety, Unrelated Variety and Technological Breakthroughs: An analysis of US State-Level Patenting[J]. Regional Studies, 2014, 49(5):1-15.

[4] Torre A, Rallet A. Proximity and Localization [J]. Regional Studies, 2005, 39(1):47-59.

[5] Zeller C. North Atlantic Innovative Relations of Swiss Pharmaceuticals and the Proximities with Regional Biotech Arenas [J]. Economic Geography, 2004, 80(1):83-111.

[6] Neffke F, Henning M, Boschma R. The Impact of Aging and Technological Relatedness on Agglomeration Externalities: a Survey Analysis[J]. Journal of Economic Geography, 2012, 12(2):485-517.

[7] Frenken K. Van Oort F, Verburg T. Related Variety, Unrelated Variety and Regional Economic Growth[J]. Regional Studies, 2007,41(5):685-697.

[8] Feldman M.O, Audretsch D.B. Innovation in cities: Science-based diversity, Specialization and Localized Competition. European Economic Review,1999,43(2):409-429.

[9] Castaldi C, Frenken K, Los B. Related Variety, Unrelated Variety and Technological Breakthroughs: An analysis of US State-Level Patenting[J]. Regional Studies, 2014, 49(5):1-15.

[10] Hansen, B.E. Threshold Effects in Non-Dynamic Panels: Estimation, Testing and Inference. Journal of Econometrics, 1999,93:345-368.