Report on the Integration of Urban Agglomerations in China

Research Group of China Development Research Foundation[1]

I. Introduction

"Better City, Better Life" is the theme of the 2010 Shanghai World Expo. It is not until now that people have realized the role of cities in building a better life. As early as 2,000 years ago, the ancient Greek philosopher Aristotle once said, "People come to the city-state for life, and stay in the city-state for a better life." At that time, the city-state was the city. Professor Edward Glaeser from Harvard University praised city as the greatest invention and the best hope of mankind in his influential book *Triumph of the City*, believing that the future of cities will determine the future of mankind. Glaeser's evaluation is based on profound insight. Cities have essentially reshaped the mechanism for interaction and cooperation of human society, strengthened the scale effect and agglomeration effect of resource allocation, promoted division of labor and specialization, promoted innovation, and enabled wealth to be created and accumulated on a larger scale.[2]

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[2] Geoffrey West (2018), *Scale, The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economics, and Companies*. China CITIC Press: Beijing.

The industrial revolution has unprecedentedly changed the type, scope and intensity of human society's utilization of resources. Cities have provided space and mechanism support for such changes, and cities themselves have therefore been rapidly expanding. The first countries to complete industrialization also took the lead in the completion of urbanization with the urban population accounting for more than 70%[3], which are mainly concentrated in Western Europe, North America and a small number of Asia-Pacific economies. However, the pace of urbanization in the world has not stagnated. After World War II (especially after the 1980s), developing economies have also started a rapid pace of industrialization and urbanization. Today, 55% of the world's population already lives in cities, and this proportion will grow rapidly in the next 20 years.[4]

With the increase of urban population and number of cities, new changes are taking place in the spatial form and structure of cities: The rise of urban agglomerations has become a remarkable global economic and geographical phenomenon. Urban agglomeration is a large-scale spatial pattern organically composed of large cities, small and medium-sized cities and suburban areas with similar spatial geography, well-connected infrastructure and frequent economic and social interactions. Convenient transportation and communication networks have not scattered the cities, but promoted higher levels of aggregation and spatial reorganization.

Through the collaborative division of labor between cities and regions, these

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[3] Urbanization is driven by a variety of factors, and a few developing countries have entered a higher stage of urbanization before industrialization was completed.

[4] United Nations Department of Economic and Social Affairs (UN DESA) (2018): *World Urbanization Trends 2018*.

urban agglomerations are becoming the growth poles of the global economy. The Bos-Wash urban agglomeration in the United States, with 2% of land and 17% of population, has created 20% of GDP. Japan's Pacific-coast urban agglomeration, with 9% of land and 53% of population, has created 60% of GDP[5]. Similar situations also occurred in the Greater London, the Greater Paris and the Rhine-Ruhr in Germany. In the United States, Japan and Western Europe, although population urbanization at the national level has remained basically stable, population and economic activities continue to gather in urban agglomerations centered on a few large cities.

Since the reform and opening up, China has experienced the largest urbanization process in human history. Over the past 40 years, the urbanization rate of China's population has increased by an average of 1 percentage point per year, from 18% at the beginning of the reform and opening up to 59.58% in 2018. By the end of 2018, China has 10 cities with a population of over 10 million and a GDP of over RMB1 trillion.

Like many other economies, China's urbanization process not only includes the increase in the number, scale and population of cities, but also the concentration of population and economic activities in urban agglomerations. In addition to the three mage-economic urban agglomerations of the Pearl River Delta, the Yangtze River Delta and Beijing-Tianjin-Hebei Urban Agglomeration, more than 10 new urban agglomerations have emerged in the eastern coastal, northeastern, central and western regions.

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[5] The Boston Consulting Group and China Development Research Foundation (2018): "Research on Beijing-Tianjin-Hebei Co-development from an International Comparative Perspective". Background Report of China Development Forum 2018.

It can be said that if we grasp the urban agglomerations, we will grasp the fundamentals of China's economy. In 2015, the 12 urban agglomerations of Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta, Central Plains, Central-southern Liaoning, Shandong Peninsula, West Side of the Straits, Wuhan, Changsha-Zhuzhou-Xiangtan, Chengdu-Chongqing, Guanzhong Plain and Harbin-Changchun accounted for more than 80% of the country's total economy. In the ten years from 2006 to 2015, these 12 urban agglomerations' share of the national economy increased by more than 10 percentage points, which means that these urban agglomerations had a faster growth. At present, China is undergoing a transformation of high-quality economic development, and the main battlefield of high-quality development transformation is urban agglomeration. Moreover, under the circumstances of increasing downward pressure on China's economy and uncertain external environment, urban agglomeration is also the key to stabilizing employment, foreign trade, investment, finance, foreign investment and expectations.

China is making great efforts to seize the great opportunities brought about by the development of urban agglomerations. As early as 2006, Guidelines of the Eleventh Five-Year Plan issued by the State put forward that “a reasonable spatial pattern of urbanization should be formed, and urbanization should be promoted with urban agglomeration as the main form”. The *National New Urbanization Planning Outline (2014-2020)*, promulgated in 2014, also proposes that urban agglomerations should be the main form of new urbanization. In the Guidelines of the Thirteenth Five-Year Plan issued in 2016, in addition to building world-class urban agglomerations of Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta, the development of 16 other urban agglomerations and two urban

circles was also proposed. In recent years, urban agglomeration development plans including Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta (Guangdong-Hong Kong-Macao Greater Bay Area) have been issued one after another, and the development of urban agglomeration has been accelerating.

The key to the development of urban agglomerations is integration. The integration of urban agglomerations relies on the connection of infrastructure and systems among cities in the region to promote the rapid flow and optimal allocation of resource elements within a larger region, promote the division and coordination of labor among cities in the region, and improve the overall productivity and balanced development level of the region. In order to measure the integration level of major urban agglomerations in China, a new method of regional integration measurement has been developed by the research group of China Development Research Foundation. This method describes regional integration from four aspects: Economic agglomeration degree (A), regional connectivity (C), economic equalization (E), and policy coordination (P), thus forming the ACEP index. ACEP index can overcome the inherent shortcomings of traditional integrated measurement methods, reflect regional competition and interaction, and is sensitive to changes in macro policies and in population and economic activities. This report measures the integration of 12 urban agglomerations from 2006 to 2015, including 157 cities at or above the prefecture level. The relevant results are instructive for policy formulation and discussion.

II. Measurement of Urban Agglomeration Integration: Scope, Method and General Situation

i. Regional scope of urban agglomerations

This report has measured 12 large urban agglomerations, including Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta, Central Plains, Central-southern Liaoning, Shandong Peninsula, West Side of the Straits, Wuhan, Changsha-Zhuzhou-Xiangtan, Chengdu-Chongqing, Guanzhong Plain and Harbin-Changchun.

The scope of these urban agglomerations is mainly based on the relevant national planning, with cities above prefecture level as the basic units within the urban agglomerations for analysis.[6] The two cities of Xingtai and Handan in Hebei are involved both in Central Henan Urban Agglomeration and in the region of Beijing-Tianjin-Hebei. In order to avoid duplication, Xingtai and Handan are excluded from Central Henan Urban Agglomeration in the analysis. In addition, this report does not adopt the planning concept of the urban agglomeration in the middle reaches of the Yangtze River, mainly considering that the overall level of urban and economic development in the region is weak and the regional scope is large, so only Wuhan Urban Agglomeration and Changsha-Zhuzhou-Xiangtan Urban Agglomeration, which already have a high integration foundation, have been investigated separately.

In the report, we adopted the definition of city in the sense of national administrative division. Therefore, the cities here include not only urban built-up areas, but also the rural areas within the administrative jurisdiction, covering the entire territory within the boundaries of the jurisdiction. There are two main considerations in this way. First, it is consistent with the current administrative

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[6] Taking the city as the measurement unit mainly takes into account the availability of data and the standardization of statistics, but this will underestimate the actual intra-regional disparities.

system and policy framework. In a jurisdiction, whether urban or rural, public services and policies are always considered as a whole. The second is to consider the functional complementarity of urban areas, suburbs, towns, villages and natural landforms, as well as the relevance of economic and social activities.

The 12 urban agglomerations examined in the report cover 157 cities at or above the prefecture level. Each urban agglomeration contains at least 6 urban units (Guanzhong and Wuhan) and at most 27 (Central Plains). Five urban agglomerations are located in the same provincial administrative region, including Pearl River Delta, Wuhan, Guanzhong, Central-southern Liaoning and Shandong Peninsula. Three urban agglomerations span four provincial administrative regions, namely the Yangtze River Delta, Central Plains and West Side of the Straits.

Table 1: Regional Scope of Twelve Major Urban Agglomerations

Urban agglomerations	Urban regions included
Beijing-Tianjin-Hebei (13 cities)	Beijing, Tianjin, Baoding, Tangshan, Langfang, Qinhuangdao, Zhangjiakou, Chengde, Shijiazhuang, Cangzhou, Handan, Xingtai and Hengshui
Yangtze River Delta (26 cities)	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
Pearl River Delta (9 cities)	Guangzhou, Shenzhen, Zhuhai, Foshan, Dongguan, Zhongshan, Jiangmen, Zhaoqing and Huizhou
Chengdu-Chongqing (16 cities)	Chongqing, Chengdu, Zigong, Luzhou, Deyang, Mianyang, Suining, Neijiang, Leshan, Nanchong, Meishan, Yibin, Guang'an, Dazhou, Ya'an and Ziyang
Wuhan (6 cities)	Wuhan, Huangshi, Ezhou, Huanggang, Xiaogan and Xianning
Changsha-Zhuzhou-Xiangtan (8 cities)	Changsha, Zhuzhou, Xiangtan, Yiyang, Loudi, Yueyang, Changde and Hengyang
Central-souther	Shenyang, Dalian, Anshan, Fushun, Benxi, Dandong, Liaoyang, Yingkou and

n Liaoning (9 cities)	Panjin
Harbin-Changchun (9 cities)	Harbin, Daqing, Qiqihar, Suihua, Changchun, Jilin, Siping, Liaoyuan and Songyuan
Guanzhong Plain (6 cities)	Xi'an, Xianyang, Baoji, Weinan, Tongchuan and Shangluo
Central Plains (27 cities)	Zhengzhou, Luoyang, Kaifeng, Nanyang, Anyang, Shangqiu, Xinxiang, Pingdingshan, Xuchang, Jiaozuo, Zhoukou, Xinyang, Zhumadian, Hebi, Puyang, Luohe, Sanmenxia, Changzhi, Jincheng, Yuncheng, Liaocheng, Heze, Suzhou, Huaibei, Fuyang, Bozhou, Bengbu
West Side of the Straits (20 cities)	Fuzhou, Xiamen, Quanzhou, Putian, Zhangzhou, Sanming, Nanping, Ningde, Longyan, Wenzhou, Lishui, Quzhou, Shangrao, Yingtan, Fuzhou, Ganzhou, Shantou, Chaozhou, Jieyang, Meizhou
Shandong Peninsula (8 cities)	Jinan, Qingdao, Zibo, Weifang, Dongying, Yantai, Weihai, Rizhao

ii. ACEP method

Traditionally, there are several ways to measure regional (economic) integration. First, examining the degree of the boundary between different regions within one urban agglomeration. If the boundary effect is weak, the flow of resource elements will be free, indicating a higher degree of integration. Second, examining the specialization of labor division between different sub-regions. The more specified labor represents the higher the level of integration. Third, examining the network for resource exchanges between key cites. A more efficient network supports a better economic integration. Apart from these, some studies also subjectively score institutional integration from the perspective of institutional cohesion, or present subjective scores in consideration with other objective measures. Among them, the boundary effect is most frequently investigated, but the specific methods and indicators differ greatly. Some studies pay much attention to the trade volumes between regions while others focus more

on the regional element flow and product prices.

These widely applied measuring methods have the following shortcomings: (1) Given the specific target region, most attention is paid to the interior regional boundary without considering the outer boundary between the target region and the outside world systematically. In fact, it is the outer boundary that really distinguishes a region from other places. (2) Interaction and competition among various regions are neglected. Some studies have assessed the integration of multiple regions at a time, but these evaluations show little relation with one another due to the different selection of models and indicators. (3) Though some studies have considered the factor of spatial distance, they only take into account the distance and other linear elements, failing to analyze issues from the perspective of plane space. (4) There are defects in the design of model and indicator systems. The design of some indices lacks the mathematical feature of simplicity. Though such design may lead to certain quantitative scores, it is difficult to carry out in-depth analysis. The indicator system of some methods is too complex and therefore is not conducive to policy evaluation for clear implications.

To address these deficiencies in the existing methods, the research group proposed a new regional integrated measurement method, which includes four basic elements: (1) Economic agglomeration degree (A), which is represented by the product of the proportion of urban agglomerations in the national economy and the regional economic density It is normalized during calculation and ranges between 0 and 1. (2) Regional connectivity (C), which is measured by the density of actually-utilized regional transportation network (passenger flow and logistics).

It is normalized during calculation and ranges between 0 and 1. (3) Economic equalization (E), which is expressed by subtracting the Gini coefficient of per capita GDP of each city in the region from 1. (4) Policy coordination (P). Since it is impossible to directly measure the connectivity between institutions and policies, we subtract the Gini coefficient of per capita fiscal expenditure in the region from 1 to reflect the coordination difficulty between institutions and policies. The higher the P value, the smaller the synergy barrier is. The index thus constructed by the weighting method is called the ACEP index and ranges between 0 and 100. A higher index represents higher regional integration. The specific calculation method of the ACEP index is given in the technical appendix of this report.

The new measurement index overcomes the inherent deficiencies of the traditional methods in several aspects: First, the economic density variable is introduced to consider the regional economy in the overall plane, and make different regions identifiable; second, the regional economic share variable is introduced to consider the competition between one region and other regions in the index. When the economic share of one region increases, the share of other regions will inevitably decrease. Third, process factors, target factors, and outcome factors are considered. The goal of regional integration is not to eliminate intra-regional differences, but to enhance the regional competitiveness as a whole, which can be described by economic density and economic share increase. Fourth, the structure of the index is mathematically excellent, which can easily decompose the change of the index into four factors and observe the contributions of different variables.

iii. Overview of urban agglomeration

The data in this report is derived from relevant provincial and prefectural statistical data. In the report, the data on a total of 157 cities above the prefecture level between 2006 and 2015 is collected. The regional GDP variable is uniformly adjusted to the constant price in 2010. Since the statistics of passenger flow and logistics have been adjusted since 2013, for the sake of consistency, we have re-adjusted the passenger flow and logistics data after 2013 to the old caliber through model simulation, which is convenient for comparative analysis.

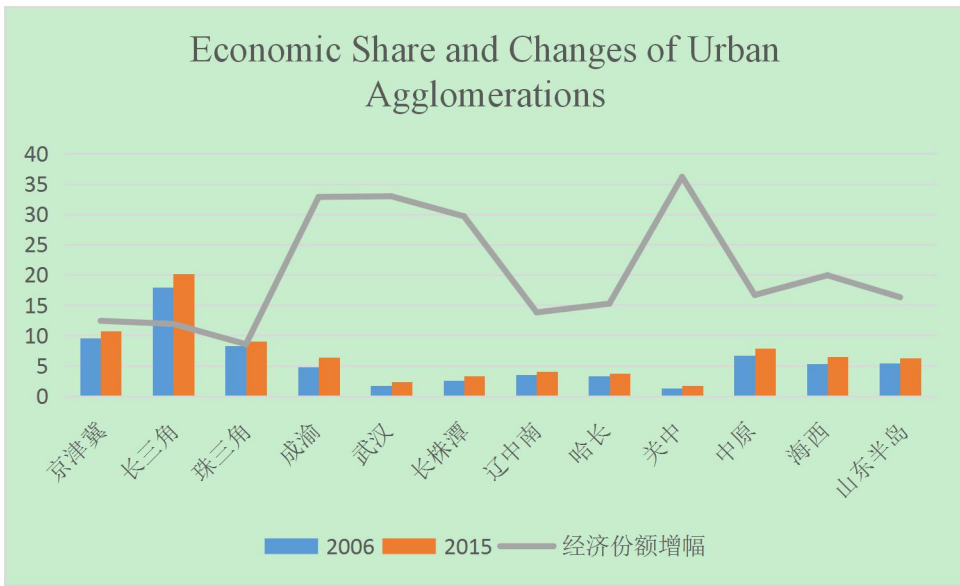
(1) Population and economic activities gather in urban agglomerations

The analysis result shows that China's economic activities and population gather in urban agglomerations. **The 12 urban agglomerations account for 19.57% of the national land area. From 2006 to 2015, the proportion of the 12 urban agglomerations in national GDP increased from 70.56% to 82.03%, showing an average annual growth higher than 1 percentage point. During the investigation period, the proportion of these urban agglomerations in the total population increases from 61.12% to 63.07%, increasing by 1.95 percentage points.**

As above mentioned, the calculation of economic agglomeration degree (A) is based on two indicators, namely regional economic share and economic density. The latter is measured by the ratio of regional economic output to land area. Figure 1 reflects the economic share of each urban agglomeration and its changes in the past decade. **Among these urban agglomerations, the top three in terms of economic share are the Yangtze River Delta Economic Circle, Beijing-Tianjin-Hebei Urban Agglomeration and the Pearl River Delta Urban Agglomeration. The economic share of the top three urban**

agglomerations exceeded 40% in 2015. In addition, **between 2006 and 2015, the proportion of all the urban agglomerations in the national economy increased.** In terms of the absolute share growth, the share of Yangtze River Delta Economic Circle has grown by 2.14 percentage points, ranking first, while the share of Beijing-Tianjin-Hebei Urban Agglomeration, Central Plains and Urban Agglomeration on the West Side of the Straits has increased by more than 1 percentage point. Regarding the relative share growth, the share of Guanzhong Plain, Chengdu-Chongqing Urban Agglomeration and Wuhan have all increased by more than 30%, while the share of Changsha-Zhuzhou-Xiangtan Agglomeration has also increased by nearly 30%. The share growth of Yangtze River Delta Economic Circle, Beijing-Tianjin-Hebei Urban Agglomeration, and the Pearl River Delta Urban Agglomeration whose original economic share is higher is the lowest.

Figure 1 Changes in Economic Share of Urban Agglomerations

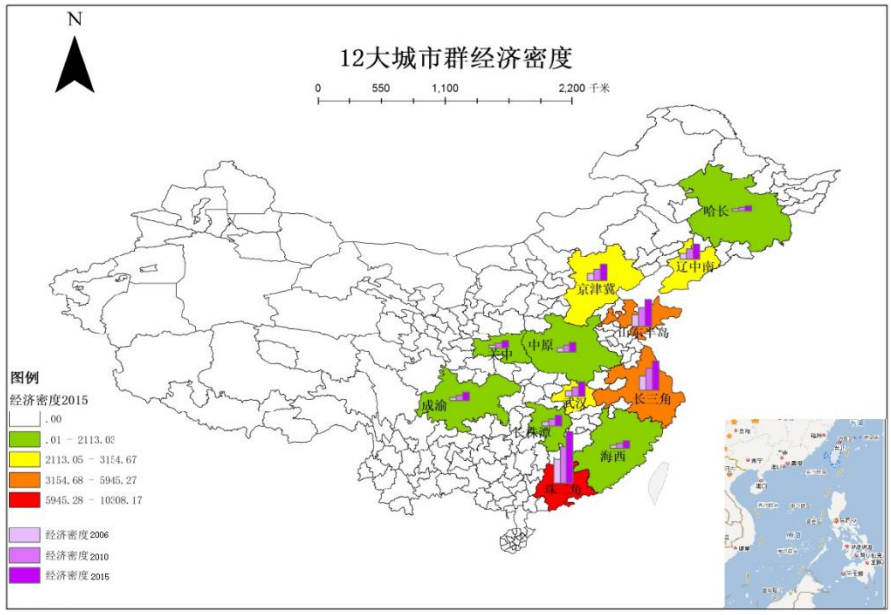


城市群经济份额及其变动，%	Economic Share and Changes of Urban Agglomerations

京津冀	Beijing-Tianjin-Hebei
长三角	Yangtze River Delta
珠三角	Pearl River Delta
成渝	Chengdu-Chongqing
武汉	Wuhan
长株潭	Changsha-Zhuzhou-Xiangtan
辽中南	Central-southern Liaoning
哈长	Harbin-Changchun
关中	Guanzhong Plain
中原	Central Plains
海西	West Side of the Straits
山东半岛	Shandong Peninsula
经济份额增幅	Growth of economic share

Figure 2 shows the changes in the regional economic density of different urban agglomerations. It can be seen that in 2015, the economic density of the Pearl River Delta Urban Agglomeration was far ahead in the investigated urban agglomerations; followed by the Yangtze River Delta Economic Circle and the Shandong Peninsula, which formed the second echelon. Beijing-Tianjin-Hebei Urban Agglomeration, Central-southern Liaoning Agglomeration and Wuhan formed the third echelon.

Figure 2 Changes in the Economic Density of Urban Agglomerations

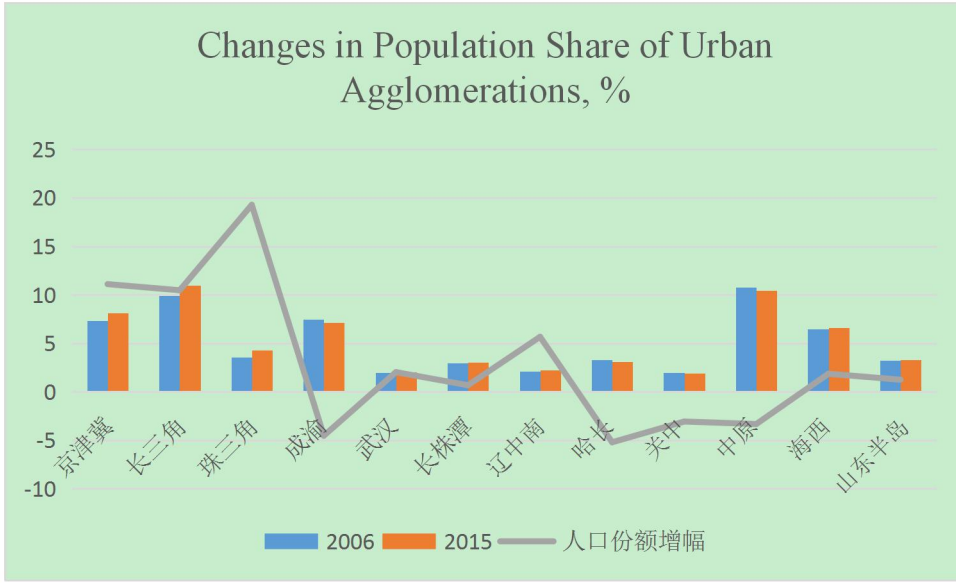


12 大城市经济群经济密度	Economic Density of 12 Urban Agglomerations
千米	Kilometer
图例	Legend
经济密度 2015	Economic density 2015
经济密度 2006	Economic density 2006
经济密度 2010	Economic density 2010
经济密度 2015	Economic density 2015
哈长	Harbin-Changchun
辽中南	Central-southern Liaoning
京津冀	Beijing-Tianjin-Hebei
山东半岛	Shandong Peninsula
中原	Central Plains
关中	Guanzhong Plain
成渝	Chengdu-Chongqing
长三角	Yangtze River Delta
武汉	Wuhan
长株潭	Changsha-Zhuzhou-Xiangtan
海西	West Side of the Straits
珠三角	Pearl River Delta

The concentration of population in urban agglomerations is closely related to economic activities. As can be seen from Figure 3, among the 12 urban agglomerations, the Yangtze River Delta Economic Circle, Central Plains, and

Beijing-Tianjin-Hebei Urban Agglomeration have the highest population shares, and the population share of Chengdu-Chongqing Urban Agglomeration and Urban Agglomeration on the West Side of the Straits also exceeds 5%. However, the population share of Central Plains was the highest in 2006, reaching 10.80%, and fell to 10.44% in 2015; while the population share of Yangtze River Delta Economic Circle rose from 9.94% in 2006 to 10.98%, ranking first among all the urban agglomerations. In terms of the absolute growth of the population share, the Yangtze River Delta Economic Circle, Beijing-Tianjin-Hebei Urban Agglomeration and the Pearl River Delta Urban Agglomeration show the highest growth. Their population share in the past decade has increased by 1.04, 0.81, and 0.69 percentage point(s) respectively. The population share of the top three urban agglomerations has increased by a total of 2.54 percentage points, which is higher than the overall population growth of all the urban agglomerations. In other words, without the population growth of these three urban agglomerations, the population share growth of the other nine urban agglomerations is negative, which reflects the population absorption capacity of the top three urban agglomerations. It can also be seen from Figure 3 that the population share of four urban agglomerations has declined over the past decade. Specifically, Harbin-Changchun Agglomeration and Chengdu-Chongqing Urban Agglomeration showed the largest declines. Regarding the relative growth of population share, the Pearl River Delta Urban Agglomeration has the highest growth close to 20%, followed by Beijing-Tianjin-Hebei Urban Agglomeration and the Yangtze River Delta Economic Circle, both of which are above 10%.

Figure 3 Changes in Population Share of Urban Agglomerations



城市群人口份额变动，%	Changes in Population Share of Urban Agglomerations, %
京津冀	Beijing-Tianjin-Hebei
长三角	Yangtze River Delta
珠三角	Pearl River Delta
成渝	Chengdu-Chongqing
武汉	Wuhan
长株潭	Changsha-Zhuzhou-Xiangtan
辽中南	Central-southern Liaoning
哈长	Harbin-Changchun
关中	Guanzhong Plain
中原	Central Plains
海西	West Side of the Straits
山东半岛	Shandong Peninsula
人口份额增幅	Growth of population share

During the investigation period, the population share of the whole urban agglomeration increased by only 3.19%, while the economic share increased by 16.26%. The vast difference between the rate of change of population share and economic share may be reflecting the alarming fact that population absorption potential of China's urban agglomerations is far from being fully developed.

People always follow where economic opportunities lead. By further analyzing

the elasticity of the change of population share to the change of economic share accordingly, we will be able to see the inclusive growth of different urban agglomerations. The results show that Pearl River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and Yangtze River Delta Urban Agglomeration displayed the highest inclusive growth rate, with the relevant elastic coefficient reaching 0.97, 0.68 and 0.49, respectively. The Central-southern Liaoning also displayed high inclusiveness, with the elastic coefficient reaching 0.24. This means that assuming the elastic relationship between economic share and population share remains unchanged, if the economic share of the Pearl River Delta region increases by 1% in the national economy, its population share will also increase by 0.97%. In the Beijing-Tianjin-Hebei Urban Agglomeration and the Yangtze River Delta Urban Agglomeration, 1% increase in the economic share can lead to in total 0.68% and 0.49 % increase in the regional population share. These results imply political connotations of paramount importance. **Under the current situation when macro-economy is facing downward pressure and the external economic environment is filled with overwhelming uncertainties, the focus of stable employment should be placed on the three major urban agglomerations namely Pearl River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and the Yangtze River Delta Urban Agglomeration.**

(2) Passenger and freight transport

Due to the lack of information on the infrastructure connectivity and the flow of transboundary factors within the urban agglomeration, this report will hence characterize the effect of connectivity based on the overall passenger and freight

flows within the urban agglomeration region.[7] By looking at passenger and freight flow respectively, we can conclude that the connectivity of urban agglomerations has been significantly improved. On comparable basis, the total volume of passenger flow of the 12 urban agglomerations in 2006 was 14.26 billion, and the total volume of freight flow was 12.91 billion tons. By 2015, these two indicators had increased to 33.21 billion and 32.62 billion tons respectively, up by 132.88% and 152.71% respectively.

By looking at urban agglomeration, the passenger transport and freight transport of each urban agglomeration show different characteristics in changing. In 2006, the Yangtze River Delta Urban Agglomeration, Chengdu-Chongqing Urban Agglomeration and Central Henan Urban Agglomeration were the urban agglomerations with the largest passenger flow; in 2015, the Yangtze River Delta Urban Agglomeration, the Pearl River Delta Urban Agglomeration and Chengdu-Chongqing Urban Agglomeration were the top three urban agglomerations with the highest passenger flow; the Pearl River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and Guanzhong Plain Urban Agglomeration were the three urban agglomerations with the most rapid growth of passenger flow. In terms of freight volume, the Yangtze River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and Central Henan Urban Agglomeration ranked the top three in 2006, while the Yangtze River Delta Urban Agglomeration, Guanzhong and Chengdu-Chongqing Urban Agglomeration ranked the top three in 2015. By investigating the passenger

[7] It is not an ideal choice to reflect the regional connectivity through total passenger traffic and freight volume. However, under the conditions of market-oriented economy, the increase in the passenger traffic and freight flow in a sub-region of an urban agglomeration mainly depends on the connectivity with surrounding areas, instead of the cycle in the sub-region.

and cargo ratio in a certain period, the passenger and cargo ratio of all cities change in a common way (see Table 2). Except for the Pearl River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and Harbin-Changchun Urban Agglomeration, the ratio of passenger and goods in other urban agglomerations all declined. The most rapid decline was in Central Henan Urban Agglomeration, Urban Agglomeration on the West Side of the Straits and Guanzhong Plain Urban Agglomeration, which may in turn reflect the decline in the relative position of the manufacturing industry and the increase in the proportion of the service industry in the Pearl River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and Harbin-Yangtze River Delta Urban Agglomeration region.

Table 2: Changes of Passenger and Freight Transport in Urban Agglomerations (2006-2015) (Unit: 10,000 people, 10,000 tons, %)

	Passenger volume (2006)	Passenger volume (2015)	Growth rate of passenger flow	Freight volume (2006)	Freight volume (2015)	Growth rate of freight flow	Passenger and cargo ratio: 2006	Passenger and cargo ratio: 2015
Beijing-Tianjin-Hebei	103,175.00	316,569.00	**206.83**	**168,095.00**	**354,868.00**	111.11	0.61	0.89
Yangtze River Delta	**324,932.00**	**662,576.00**	103.91	**311,917.00**	**709,702.00**	127.53	1.04	0.93
Pearl River Delta	143,849.00	**593,403.00**	**312.52**	103,201.00	267,496.00	159.20	**1.39**	**2.22**
Chengdu-Chongqing	**217,216.00**	**443,732.00**	104.28	115,001.00	311,423.00	**170.80**	**1.89**	**1.42**
Wuhan	38,627.00	76,846.00	98.94	37,291.00	82,474.00	121.16	1.04	0.93
Changsha-Zhuzhou-Xiangtan	75,132.00	154,317.00	105.39	62,301.00	160,000.00	156.82	1.21	0.96
Central-southern Liaoning	47,432.00	94,748.00	99.76	85,322.00	196,879.00	130.75	0.56	0.48
Harbin-Changc	37,161.00	86,652.00	133.18	46,354.00	85,340.00	84.10	0.80	1.02

hun								
Guanzhong Plain	31,397.00	98,813.00	**214.72**	23,793.00	97,779.00	**310.96**	**1.32**	1.01
Central Plains	**153,130.00**	378,629.00	147.26	**143,905.00**	**592,732.00**	**311.89**	1.06	0.64
West Side of the Straits	127,009.00	214,847.00	69.16	96,876.00	221,334.00	128.47	1.31	0.97
Shandong Peninsula	127,009.00	199,854.00	57.35	96,876.00	182,343.00	88.22	1.31	**1.10**
All urban agglomerations	1,426,069.00	3,320,986.00	132.88	1,290,932.00	3,262,371.00	152.71	1.10	1.02

(3) Regional economic gap

The Gini coefficient is a common indicator of income inequality. This report calculated the Gini coefficient of GDP per capita in urban agglomerations to describe the regional economic development gap within the urban agglomerations. As can be seen from Figure 3, among the 12 urban agglomerations except for the Shandong Peninsula which the internal gap increased slightly from 2006 to 2015, the economic development gap in all other urban agglomerations has decreased. However, the development gap in Shandong Peninsula was originally the smallest among all urban agglomerations, and the gap growth was so small that it was almost negligible. The Yangtze River Delta Urban Agglomeration, Wuhan and the Beijing-Tianjin-Hebei Urban Agglomeration were taking the lead in the absolute value of the reduction in economic gap. In terms of the relative extent of gap reduction, the Central-southern Liaoning Agglomeration, Yangtze River Delta Urban Agglomeration and Chengdu-Chongqing Urban Agglomeration are the top three. Central Henan Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration, Wuhan and the Pearl River Delta Urban Agglomeration reduced more than 10% too.

The narrowing of regional development gap in urban agglomerations gave us momentous enlightenment on policies. Since the reform and opening up, the

development gap between urban and rural areas and between regions in China's economy has been expanding rapidly, and the excessively large development gap has become an important risk factor restricting the sustainability of economic and social development. Starting from around 2005, with the promotion and implementation of China`s western area development policy, regional development gaps on broad terms were shrinking accordingly. However, the gap in the distribution of residents' income did not start to decline until 2009 and has rebounded in the last two years. **To promote inclusive economic development and enhance balanced development of urban and rural areas and regional economy based on urban agglomeration is a choice of policy worth considering.**

Table 3: Changes in Economic Disparities among Urban Agglomerations

	(1) Gini coefficient of GDP 2006	(2) Gini coefficient of GDP 2015	Economic gap change (2)-(1)	Percentage change in economic gap, %
Beijing-Tianjin-Hebei	**0.3227**	**0.2780**	**-0.0447**	-13.86
Yangtze River Delta	0.2475	0.1955	**-0.0520**	**-21.00**
Pearl River Delta	0.2027	0.1698	-0.0329	-16.24
Chengdu-Chongqing	0.2190	0.1791	-0.0399	**-18.22**
Wuhan	**0.3412**	**0.2887**	**-0.0526**	-15.40
Changsha-Zhuzhou-Xiangtan	0.2676	0.2524	-0.0152	-5.68
Central-southern Liaoning	0.1755	0.1309	-0.0446	**-25.43**
Harbin-Changchun	**0.2787**	**0.2749**	-0.0038	-1.35
Guanzhong Plain	0.2211	0.2051	-0.0160	-7.24
Central Plains	0.2698	0.2292	-0.0407	-15.07
West Side of the Straits	0.2602	0.2458	-0.0144	-5.54
Shandong Peninsula	0.1522	0.1529	0.0007	0.44

(4) Gap in regional fiscal expenditure

This report uses the gap in public fiscal expenditure in urban agglomeration regions to describe the institutional and policy differences among regions. The government's public expenditure is channeled into infrastructure and various public services. These services have crucial implications for the flow of resource factors. If the gap in public expenditure within the region is larger, the resource factors are more likely to flow to the region with high public expenditure, which will widen the internal development gap. In addition, if the gap in public expenditure within the region is larger, the gap in public service level will also be expanding and the economic and administrative cost of coordinating the policies of each sub-region will also be increased.

As can be seen from Table 4, during the investigation period, the fiscal expenditure gap within all urban agglomerations has been narrowed except for the Pearl River Delta Urban Agglomeration. Except for Chengdu-Chongqing Urban Agglomeration and the Pearl River Delta Urban Agglomeration, the Gini coefficient of fiscal expenditure in other urban agglomerations has been reduced by more than 10%. In 2006, the Gini coefficient of internal fiscal expenditure in the Beijing-Tianjin-Hebei Urban Agglomeration, the Yangtze River Delta Urban Agglomeration and Wuhan Urban Agglomeration ranked top three, among which the gap between the cities in Beijing-Tianjin-Hebei Urban Agglomeration was the most prominent, reaching 0.4435. The Gini coefficient for fiscal expenditure in the Pearl River Delta Urban Agglomeration is also close to 0.30, ranking fourth. As at 2015, the Beijing-Tianjin-Hebei Urban Agglomeration, the Pearl River Delta Urban Agglomeration and the Yangtze River Delta Urban Agglomeration were the three urban agglomerations with the largest gap in fiscal expenditure, and the Beijing-Tianjin-Hebei Urban Agglomeration ranked first among all urban

agglomerations with a value of 0.3538. From the absolute extent of the reduction, the Yangtze River Delta Urban Agglomeration, Wuhan and Beijing-Tianjin-Hebei Urban Agglomeration ranked top three. In terms of the relative reduction, the Yangtze River Delta Urban Agglomeration, Central Henan Urban Agglomeration and Wuhan are the most prominent, with a reduction of over 40%. It is worth mentioning that the Yangtze River Delta Urban Agglomeration is a model in narrowing the gap in fiscal expenditure within the region, both in absolute and relative terms.

If we compare the economic development gap and fiscal expenditure gap between different regions, we will be able to discover an interesting phenomenon. **In 2006, there were four urban agglomerations in the region where the gap in fiscal expenditure was greater than that in economy, namely the Yangtze River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration, Pearl River Delta Urban Agglomeration and Shandong Peninsula. The rest were all opposite. These four urban agglomerations were all located in the traditionally economically strong regions.** As at 2015, there were still four urban agglomerations where the gap in regional fiscal expenditure was larger than that in economy, among which the Yangtze River Delta Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration and the Pearl River Delta Urban Agglomeration were still included, and the Shandong Peninsula was replaced by Chengdu-Chongqing Urban Agglomeration. One possible reason why the gap in fiscal expenditure is greater than that in economic development is that central cities in developed regions have more corporate headquarters, which can easily be converted into unequal spending levels under the current tax system. Due to the existence of many central fiscal transfer payments in less developed areas, these

payments were usually associated with the most basic public service expenditure, thus achieving an equalization effect. It is an interesting phenomenon that Chengdu-Chongqing Urban Agglomeration replaces the Shandong Peninsula, which is consistent with the influence of Chengdu-Chongqing City Group on China's economic map in recent years. **In addition, except for the Pearl River Delta Urban Agglomeration and Chengdu-Chongqing Urban Agglomeration, the gap between fiscal expenditure and economic development in other urban agglomerations becomes smaller, and the fiscal equalization is more rapid than the economic equalization.**

Table 4: Changes in Fiscal Expenditure Gap within Urban Agglomerations

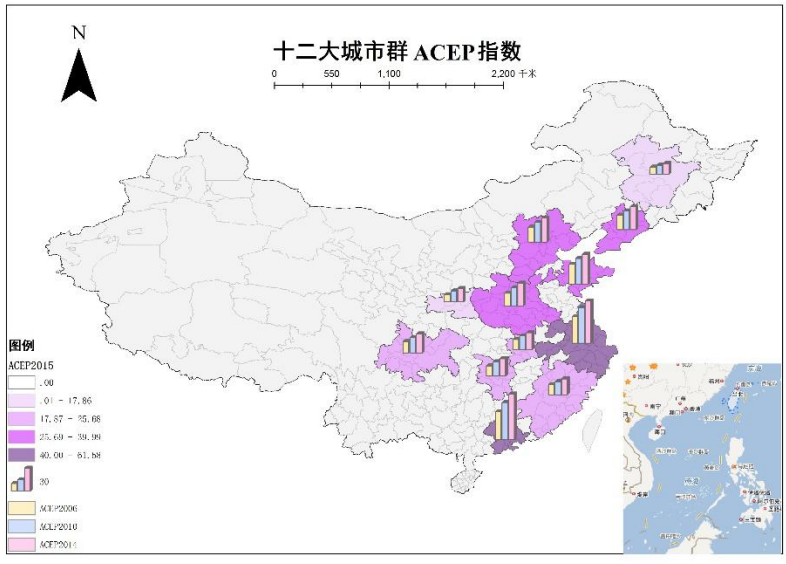
	(1) Gini coefficient of fiscal expenditure 2006	(2) Gini coefficient of fiscal expenditure 2015	(1)-(2)	Rate of reduction, %
Beijing-Tianjin-Hebei	**0.4435**	**0.3558**	**-0.0876**	-19.76
Yangtze River Delta	**0.3860**	**0.2255**	**-0.1605**	**-41.58**
Pearl River Delta	0.2902	**0.3040**	0.0138	4.77
Chengdu-Chongqing	0.1923	0.1810	-0.0112	-5.84
Wuhan	**0.3013**	0.1707	**-0.1306**	**-43.34**
Changsha-Zhuzhou-Xiangtan	0.1904	0.1361	-0.0543	-28.51
Central-southern Liaoning	0.1691	0.1285	-0.0406	-24.03
Harbin-Changchun	0.1380	0.0955	-0.0424	-30.74
Guanzhong Plain	0.1515	0.1305	-0.0210	-13.85
Central Plains	0.2063	0.1163	-0.0900	**-43.61**
West Side of the Straits	0.2355	0.1699	-0.0655	-27.82
Shandong Peninsula	0.1650	0.1463	-0.0186	-11.29

III. Trend and Characteristics of Urban Agglomeration Integration

With the ACEP index, it can be found that the integration level of China's 12 urban agglomerations significantly improved during the investigation period,

which reflects the improvement of urbanization quality. However, there was also differentiation in the integration of different regions (Figure 4). The improvement of China's regional integration is mainly driven by the improvement of economic agglomeration and regional connectivity.

Figure 4: Differentiated Urban Agglomeration Integration



十二大城市群 ACEP 指数	ACEP Index of 12 Major Urban Agglomerations
千米	Kilometer
图例	Legend

i. Level and trend of ACEP index of urban agglomerations

During the investigation and report period, the ACEP index of China's 12 urban agglomerations grew steadily. In 2006, the simple average score for all urban agglomerations was 18.62, which increased to 31.37 in 2015, up by 68.45%. Among the 12 urban agglomerations, according to the level of integration and the trend of change, basically three tiers can be divided (Figure 5).

The first tier is the Pearl River Delta Urban Agglomeration and the Yangtze River Delta Urban Agglomeration. The integration level of these two urban agglomerations was significantly higher than that of other urban agglomerations in 2006, and continued to be well ahead in the following decade. In 2015, the ACEP indices for the Pearl River Delta Urban Agglomeration and the Yangtze River Delta Urban Agglomeration were 61.58 and 56.79 respectively.

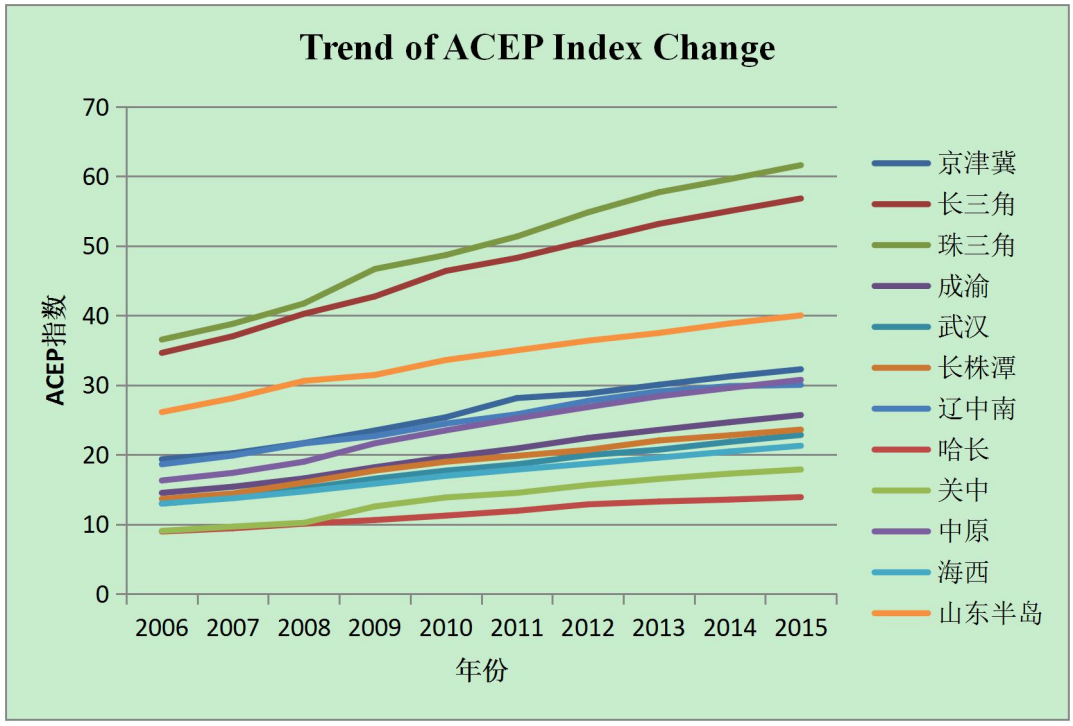
The second tier consists of Shandong Peninsula Urban Agglomeration, Beijing-Tianjin-Hebei Urban Agglomeration, Central Henan Urban Agglomeration and Central-southern Liaoning Urban Agglomeration. As at 2015, the ACEP index for these four urban agglomerations was between 30 and 40. Specifically, Shandong Peninsula has been in the leading position in the second tier since 2006.

The third tier consists of the remaining urban agglomerations. In 2015, the ACEP indices of these urban agglomerations were distributed around 15-25 scores. In the third tier, the four urban agglomerations of Chengdu-Chongqing, Changsha-Zhuzhou-Xiangtan, Wuhan and West Side of the Straits scored

similarly while the integration level of Harbin-Changchun and Guanzhong Plain was at the bottom.

From the perspective of the ACEP index, the level of integration of various urban agglomerations has remained generally stable. However, there are some urban agglomerations that have changed in the past 10 years with important economic and geographical implications. The transcendence between the two urban agglomerations is worthy of attention: First, Wuhan surpasses West Side of the Straits and maintains its leading position. Second, the Central Henan Urban Agglomeration surpasses Central-southern Liaoning Urban Agglomeration. **Both of these transcendences occurred in the central areas to the coastal areas, reflecting the overwhelming rise of urban agglomerations in the central region during the investigation period.** In addition, the level of integration of Guanzhong Plain Urban Agglomeration was basically the same as that of Harbin-Changchun in the early stage of measurement, but it is also worthy of attention since the latter was rapidly cast off since 2009.

Figure 5: ACEP Index Changes in Each Urban Agglomeration



ACEP 指数变化趋势	Trend of ACEP Index Change
ACEP 指数	ACEP index
年份	Year
京津冀	Beijing-Tianjin-Hebei
长三角	Yangtze River Delta
珠三角	Pearl River Delta
成渝	Chengdu-Chongqing
武汉	Wuhan
长株潭	Changsha-Zhuzhou-Xiangtan
辽中南	Central-southern Liaoning
哈长	Harbin-Changchun
关中	Guanzhong Plain
中原	Central Plains
海西	West Side of the Straits
山东半岛	Shandong Peninsula

ii. Decomposition and analysis of integration drive factors

An important mathematical feature of the ACEP index is the ability to decompose

the change in the total index into the contribution rates of the four sub-items A, C, E, and P. **In general, regional economic agglomeration contributed the most to the improvement of the integration index, followed by the improvement of traffic connectivity.** When the changes in the integration index of each year are decomposed, the contribution of economic agglomeration accounts for 55.75%, the contribution of connectivity accounts for 41.29%, the economy equalizes 1.50%, and the policy synergy is 1.46% generally.

However, there are also differences in the main drivers of integration in different regions. The average contribution of various factors during the investigation period shows that the connectivity contribution exceeds 50% in Central-southern Liaoning Urban Agglomeration, Pearl River Delta Urban Agglomeration and Central Henan Urban Agglomeration, which is the most important integration driving factor. Specifically, the contribution rate of this factor in Central-southern Liaoning Urban Agglomeration exceeds 65%. In the urban agglomerations of Shandong Peninsula, Changsha-Zhuzhou-Xiangtan, Chengdu-Chongqing, Guanzhong Plain, Harbin-Changchun and Wuhan, the economic agglomeration has contributed over 60%. Specifically, the contribution of this factor in the Shandong Peninsula is more than 70%. In the Yangtze River Delta Urban Agglomeration and Beijing-Tianjin-Hebei Urban Agglomeration, the policy coordination to integration is more prominent than that in other regions, reaching 9.8% and 5.9% respectively. Besides, it is also worth noting that the contribution of policy coordination to the Pearl River Delta is negative.[8]

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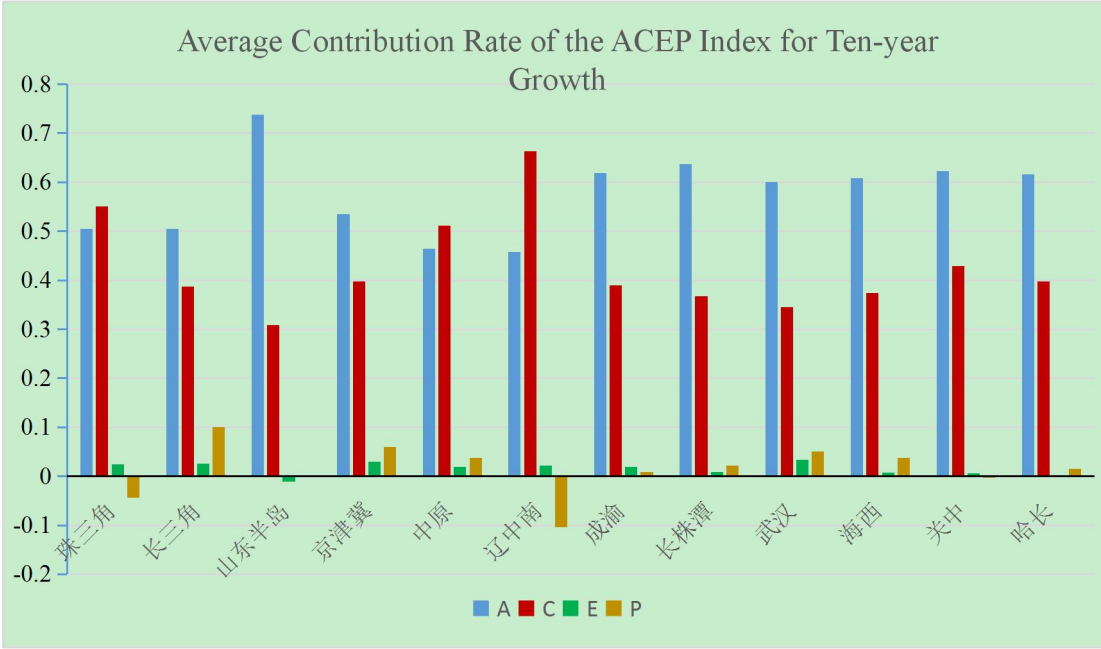
[8] The abnormal data of Central-southern Liaoning Urban Agglomeration in 2015 caused the average contribution rate of policy coordination in each year to be negative. Such abnormality may be related to the material change in the statistics of local economy and relevant information, affecting the result of index decomposition and analysis. Therefore, though this

Figure 6: Decomposition of ACEP Index Contribution Rate



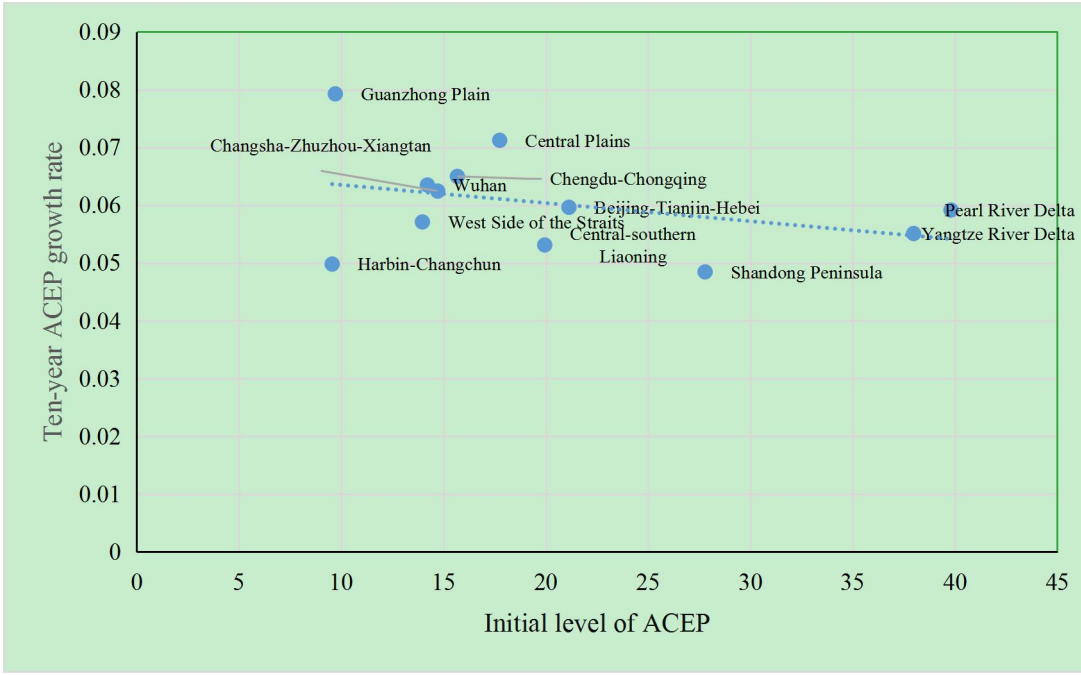
ACEP 指数十年增长的平均贡献率	Average Contribution Rate of the ACEP Index for Ten-year Growth
珠三角	Pearl River Delta
长三角	Yangtze River Delta
山东半岛	Shandong Peninsula
京津冀	Beijing-Tianjin-Hebei
中原	Central Plains
辽中南	Central-southern Liaoning
成渝	Chengdu-Chongqing
长株潭	Changsha-Zhuzhou-Xiangtan
武汉	Wuhan
海西	West Side of the Straits
关中	Guanzhong Plain
哈长	Harbin-Changchun

iii. Packet convergence of the ACEP index

report presents the analysis result, it handles the case as an exception without too much discussion.

There is a convergence trend in the level of urban agglomeration integration, reflecting the balanced progress of regional economy. During the investigation period, the population-weighted average increase of the integration index of 12 urban agglomerations reached 70%. In urban agglomerations with a high initial level of integration, the rate of integration growth is relatively slow (Figure 7). The integration speed of urban agglomerations of Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta and Shandong Peninsula has been lower than the average growth rate in the past ten years. Specifically, the growth rate of Shandong Peninsula is the lowest among the 12 urban agglomerations. The integration of urban agglomerations in the central and western regions was relatively fast, with the index increases of Guanzhong Plain Urban Agglomeration, Chengdu-Chongqing Urban Agglomeration and Wuhan reaching 97.7%, 77.12% and 76.08% respectively, which ranked top. Central-southern Liaoning Urban Agglomeration also had a relatively high growth rate in the same period, reaching 84.40%, ranking second. The integration speed of Changsha-Zhuzhou-Xiangtan Urban Agglomeration was above average. These reflect new trends in balanced regional development. Harbin-Changchun region is a notable exception, with the lowest initial integration level and the second-lowest growth rate among the 12 urban agglomerations.

Figure 7: Initial Integration Level and Long-term Integration Growth Rate



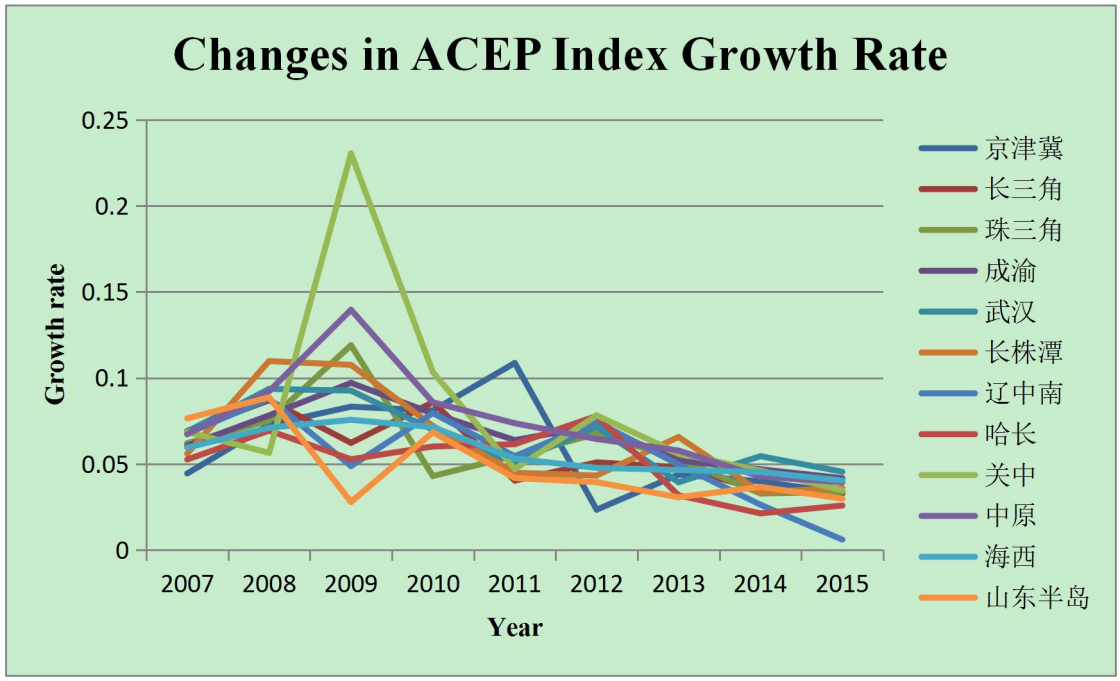
十年 ACEP 增长率	Ten-year ACEP growth rate
ACEP 初始水平	Initial level of ACEP
珠三角	Pearl River Delta
长三角	Yangtze River Delta
山东半岛	Shandong Peninsula
京津冀	Beijing-Tianjin-Hebei
辽中南	Central-southern Liaoning
中原	Central Plains
成渝	Chengdu-Chongqing
武汉	Wuhan
海西	West Side of the Straits
关中	Guanzhong Plain
长株潭	Changsha-Zhuzhou-Xiangtan
哈长	Harbin-Changchun

iv. ACEP index fluctuation between years

During the investigation, the integration growth rates of different urban agglomerations were generally the same, but of significant gaps in certain years.

As shown in Figure 8, the gap between the integration growth rates of urban agglomerations continued to expand during 2007 to 2009, and reached its peak in 2009. After that, it gradually narrowed down and resumed the synchronization. Judging from the comparison of regions, there are significant fluctuations in Guanzhong Plain Urban Agglomeration, Central Henan Urban Agglomeration and Central-southern Liaoning Urban Agglomeration, and after 2013, the integration growth rate of Central-southern Liaoning Urban Agglomeration declined the most significantly.

Figure 8 Changes in ACEP Index Growth Rate

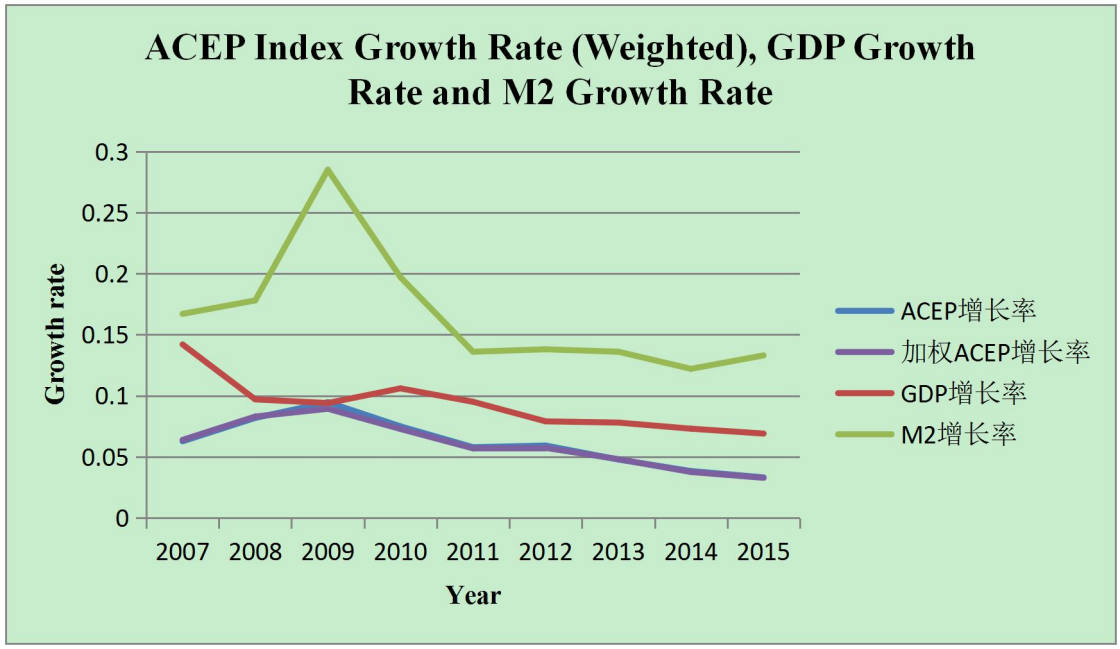


ACEP 指数的增长率变化情况	Changes in ACEP Index Growth Rate
增长率	Growth rate
年份	Year
京津冀	Beijing-Tianjin-Hebei
长三角	Yangtze River Delta
珠三角	Pearl River Delta
成渝	Chengdu-Chongqing

武汉	Wuhan
长株潭	Changsha-Zhuzhou-Xiangtan
辽中南	Central-southern Liaoning
哈长	Harbin-Changchun
关中	Guanzhong Plain
中原	Central Plains
海西	West Side of the Straits

Changes in ACEP index growth rates between different urban agglomerations may be a result of macroeconomic policies. Overall growth rates of ACEP index, GDP and M2 are compared in Figure 9, indicating that the growth rate of ACEP index speeded up from 2007 to 2009, and gradually went down after that, similar to those of M2 and GDP. However, the figure also tells that, although the monetary growth recovered in 2015, ACEP index growth rate continued to drop, which may reflect the weak stimulation effect of monetary policies.

Figure 9 Comparison on the Growth Rates of ACEP Index, GDP and M2

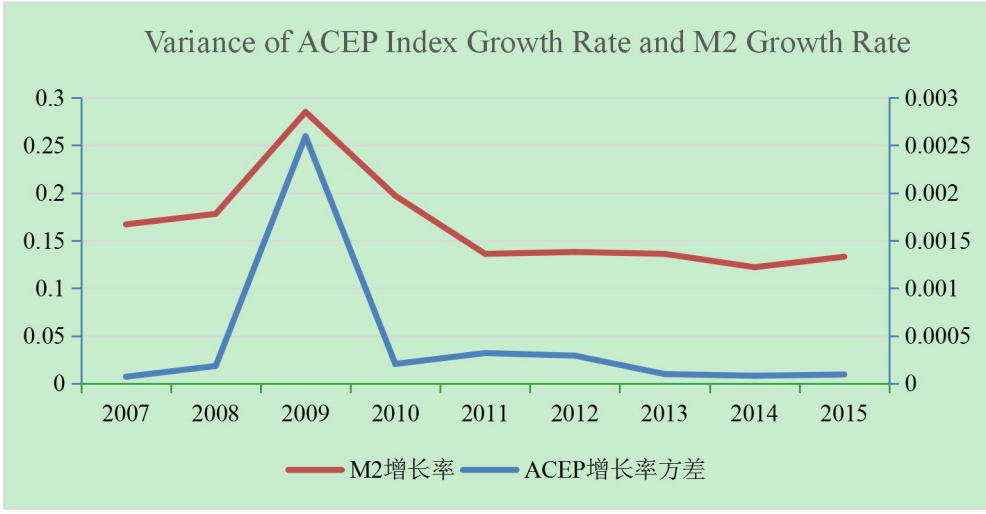


ACEP 指数增长率(加权)、GDP 增长率及 M2 增长率	ACEP Index Growth Rate (Weighted), GDP Growth Rate and M2 Growth Rate
增长率	Growth rate
年份	Year
ACEP 增长率	ACEP Growth Rate
加权 ACEP 增长率	Weighted ACEP Growth Rate
GDP 增长率	GDP Growth Rate
M2 增长率	M2 Growth Rate

To further analyze the relationship between ACEP index growth rate and monetary policies, we further compared the variance of ACEP growth rate between urban agglomerations with the trend of M2 growth rate (Figure 10). By comparison, it is found that the change of the two shared a high degree of consistency. Therefore, we speculated that the sudden enlargement and reduction of the gap between ACEP index growth rates of urban agglomerations may be caused by the different effect of monetary policies on different regions. Some regions were likely to benefit more from monetary easing, leading to a super-rapid growth of ACEP index. Further investigation shows that Guanzhong Plain Urban

Agglomeration benefits the most, with an index growth rate reaching 23.05% in 2009, followed by Central Henan Urban Agglomeration and the Pearl River Delta Urban Agglomeration, while the ACEP growth rate of Guanzhong Plain Urban Agglomeration in that year was nearly twice of those of Henan Urban Agglomeration and the Pearl River Delta Urban Agglomeration.

Figure 10 Variance of ACEP Index Growth Rate and M2 Growth Rate

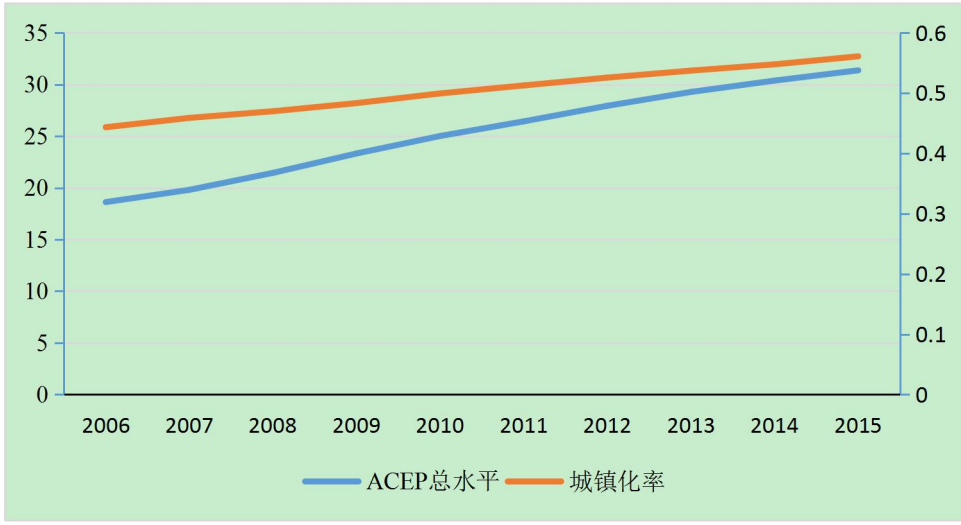


ACEP 增长率的方差和 M2 增长率	Variance of ACEP Index Growth Rate and M2 Growth Rate
M2 增长率	M2 Growth Rate
ACEP 增长率方差	Variance of ACEP Index Growth Rate

v. Urbanization quality in ACEP index change

Urban agglomeration integration brings the opportunity for urbanization quality improvement. Aggregate ACEP level and demographic urbanization rate are compared in Figure 11, indicating that during the investigation, both the urbanization rate and the ACEP index went up steadily, while the former more gently and the later more sharply. It means that, when the urbanization was developing steadily, its quality was improving much more rapidly.

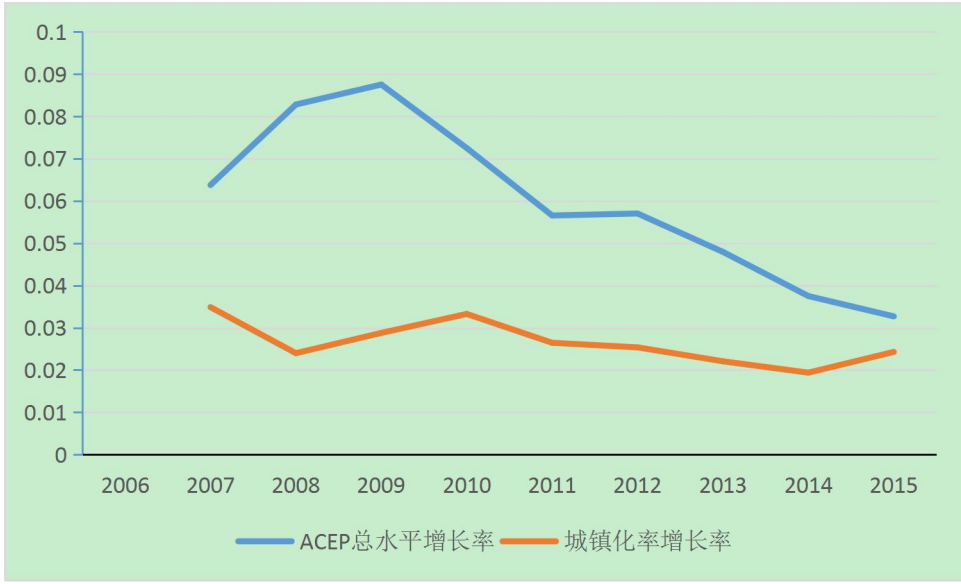
Figure 11 Aggregate ACEP Level and Urbanization Rate



ACEP 总水平	Aggregate ACEP Level
城镇化率	Urbanization Rate

Figure 12 Further Comparison on the Trend of ACEP Index Change Rate and Urbanization Growth Rate It can be found that, since 2007, ACEP index has maintained a rapid growth. But after 2009, it kept dropping at high speed, while the urbanization growth rate was at a lower one and enjoyed a significant rebound during 2014 to 2015. The gap between the two growth rates narrowed, reminding us to pay attention to the hidden worry behind the slow improvement of urbanization quality.

Figure 12 ACEP Index Growth Rate and Urbanization Growth Rate



ACEP 总水平增长率	Aggregate ACEP Level Growth Rate
城镇化率增长率	Urbanization Growth Rate

IV. Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta Urban Agglomerations in ACEP Index

Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta Urban Agglomerations have the potential to become world-class urban agglomerations. In 2015, the economic aggregate of these three major urban agglomerations accounted for over 40% of the national total, and half of that of the 12 urban agglomerations. When judging these three major urban agglomerations from the perspective of ACEP index, they have their obvious strengths and shortcomings, which provides an orientation for promoting the integration of these three major urban agglomerations in the next level.

i. Beijing-Tianjin-Hebei Urban Agglomeration

Beijing-Tianjin-Hebei region is located in the northern part of the North China

Plain, containing Beijing Municipality, Tianjin Municipality and Hebei Province. This urban agglomeration covers regions geographically connected, culturally similar, and sharing deep historical origin, with regional integrity and profound cultural affinity, being one of the major clusters of population and social activities together with Yangtze River Delta and Pearl River Delta urban agglomerations.[9]

Beijing-Tianjin-Hebei Urban Agglomeration enjoys significant strategic position on China's development map. In this agglomeration, Beijing, the capital, is the political and cultural center of the country, as well as the center of international exchanges and scientific and technological innovation, enjoying significant international impact. Tianjin, a national central city, is the economic center for the northern and Bohai coastal regions, as well as an international shipping and logistics center, provided with national comprehensive supporting reform and financial reform pilot zones. Hebei Province, as the development hinterland of Beijing and Tianjin, it provides supports for both ecological environment and resource elements for the development of Beijing and Tianjin, enjoying great potential for urbanization and industrial structure transformation. Located at the heartland of Bohai coastal region and Northeast Asia and with significant regional strength and geopolitical standing, the region, as a whole, is the most important growth pole and opening-up highland of in Northern China that enjoys the country's leading technological and educational resources, world-class sea, land and air transportation hubs, solid industrial foundation and other advantages. However, Beijing-Tianjin-Hebei region is also facing a series of significant challenges. The region suffers from extremely weak ecological environment and

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[9]*Report on Regional Development of Beijing-Tianjin-Hebei Urban Agglomeration*, Chief Editor: Li Guoping, China Remin University Press, March 2013

resource carrying capacity, keen urban diseases of central cities, and seriously unbalanced regional economic and social development.[10]

In April, 2015, the Political Bureau of the CPC Central Committee reviewed and approved the *Outline for Beijing-Tianjin-Hebei Co-development Planning*. The Outline states that Beijing-Tianjin-Hebei Co-development is a national material strategy centering on the orderly relief of Beijing's non-capital functions, which shall be made breakthroughs in major fields such as Beijing-Tianjin-Hebei transportation integration, ecological environment protection and industrial upgrading and transfer.

The development of Beijing-Tianjin-Hebei regional development shall center on Beijing, focus on Hebei, and lie its difficulty in tripartite regional coordination. As a capital city, Beijing has a huge impact on the whole country even the whole world. Its every move is under the spotlight, and its severe metropolitan diseases have attracted the attention of the whole country even the whole world. Hebei Province is subjected to arduous development tasks. As its stage and level of economic and social development are far behind those of the regional central cities - Beijing and Tianjin, and its fragile ecological environment restrains its ability to support the long-term and healthy development of Beijing and Tianjin, it is the focus of this regional development. Coordinated development has to break the interest barriers that have been formed and solidified for a long time under the original system and mechanism, so, it is difficult.

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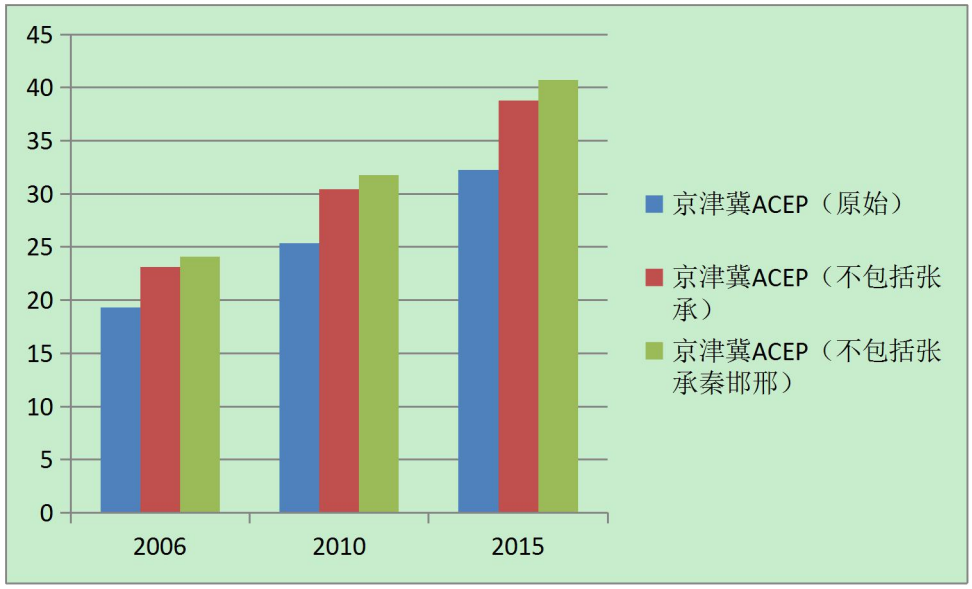
[10] China Development Research Foundation (2014): *Research on Beijing-Tianjin-Hebei Co-development*.

In understanding the challenges of coordinated development of Beijing-Tianjin-Hebei Urban Agglomeration, an important consideration is to investigate the integration index of different regions in Beijing-Tianjin-Hebei Urban Agglomeration. Integration indexes of Beijing-Tianjin-Hebei Urban Agglomeration in three different ranges are calculated separately in Figure 13. The first range is the Beijing-Tianjin-Hebei coordinated region officially defined (including Beijing, Tianjin and 11 cities in Hebei Province), the second range is the ACEP index excluding Zhangjiakou and Chengde, and the third is the ACEP index excluding Zhangjiakou, Chengde, Qinhuangdao, Handan and Xingtai. The results indicate that, in 2015, the integration index of the whole region was 32.25, and that excluding Zhangjiakou and Chengde was 38.79. When excluding Zhangjiakou, Chengde, Qinhuangdao, Handan and Xingtai, the integration index rose to 40.74, which exceeded that of Shandong Province and ranked the third in the country. Changing with regional ranges, ACEP indices reflect the difficulties of Beijing-Tianjin-Hebei integration to some extent. However, this is not to say that the integration of Beijing-Tianjin-Hebei Urban Agglomeration shall exclude Zhangjiakou, Chengde, Qinhuangdao, Handan and Xingtai. In fact, these five cities assume their unique functions in the region.

Figure 13 ACEP Indices of Beijing-Tianjin-Hebei Urban Agglomeration in Different Regional Range



京津冀 ACEP（原始）	Beijing-Tianjin-Hebei ACEP (original)
京津冀 ACEP（不包括张承）	Beijing-Tianjin-Hebei ACEP (excluding Zhangjiakou and Chengde)
京津冀 ACEP（不包括张承秦邯邢）	Beijing-Tianjin-Hebei ACEP (excluding Zhangjiakou, Chengde, Qinhuangdao, Handan and Xingtai).

Further analysis of the ACEP indices of Beijing-Tianjin-Hebei Urban Agglomeration and the contribution rate of each factor to the change of indexes reveals the following points. The low integration index of Beijing-Tianjin-Hebei Urban Agglomeration lies mainly in the huge development gap between Beijing and Tianjin and cities in Hebei Province. And the huge gap in public fiscal expenditure in the region also serves as a major factor for the low scoring. Therefore, to promote the economic integration of this region, we shall first share the high-quality development resources of Beijing and Tianjin with Hebei Province, and then enhance the equalization of public finance capacity and expenditure level in the region with the transverse transfer and payment between the central government and the local governments.

Two variables are crucial to the integration of Beijing-Tianjin-Hebei Urban Agglomeration in the future. One is how to promote the equalization of economic development level and fiscal expenditure of Beijing-Tianjin-Hebei Urban Agglomeration with the support of the construction of Xiongan New Area. 'However, with the support of Xiongan New Area does not means to solve the problem only by simple distribution of Beijing and Tianjin's resources to Hebei Province, but to promote the balanced development of other cities in Hebei Province with the opportunities brought about by the construction of Xiongan New Area. The other one is, except for the self-development of Beijing-Tianjin-Hebei Urban Agglomeration, how to form a wider Bohai coastal economic circle by centering on Beijing-Tianjin-Hebei Urban Agglomeration and coordinating with Shandong Peninsula Urban Agglomeration and Central-southern Liaoning Urban Agglomeration, so as to promote the regional economic integration of the whole Northeast Asia in the case of mature external conditions, which is important to the resolution of issues that Beijing-Tianjin-Hebei Urban Agglomeration is facing. In 2015, the economic aggregate of three major urban agglomerations in Bohai bay region accounted for over 20% of the national total, equivalent to that of Yangtze-River-Delta Urban Agglomeration.

As shown in the above discussion and analysis that the economic development of Beijing-Tianjin-Hebei Urban Agglomeration is of high population absorption, which is a positive factor that shall be valued and gave play to in the future development of the region. To overcome the urban diseases of Beijing, Tianjin and other mega cities caused by the overcrowding of population and resources, we shall, at the time of promoting the integration of Beijing-Tianjin-Hebei Urban

Agglomeration, adhere to the principle of "concentration for the larger and for decentralization for the smaller" to complete the spatial distribution of population within urban agglomerations.

ii. Guangdong-Hong Kong-Macao Greater Bay Area

Guangdong-Hong Kong-Macao Greater Bay Area consists of Pearl River Delta Urban Agglomeration, Hong Kong and Macao. With a total area of 56,000 square kilometers and a total population of 70 million by the end of the year 2018, it is one of the most open and economically dynamic regions in China. The Greater Bay Area has important geographical influence, has three kinds of systems and currencies and radiates to Southeast Asia and the Indian Ocean. Its financial influence and international level rank among the top three urban agglomerations.

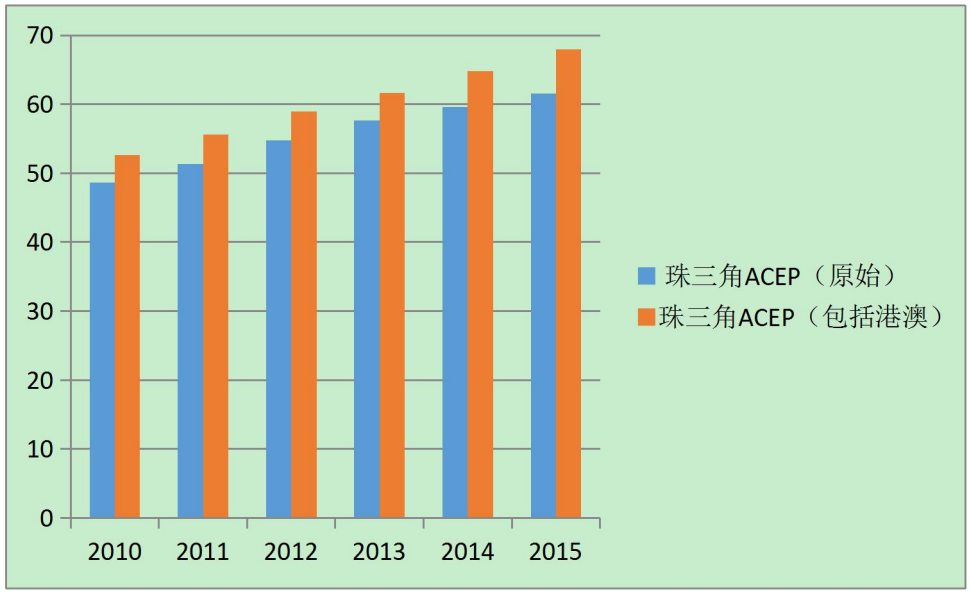
The integration of Pearl River Delta Urban Agglomeration has been steadily walking in the forefront of China’s urban agglomeration. However, Pearl River Delta Urban Agglomeration has some limitations in itself, which are particularly evident in the small hinterland, small regional economic aggregate and the fact that it has been already in a high-density state. There is little room for further improvement, and new momentum needs to be injected into the development of regional economy.

From the perspective of ACEP index, it has shown its necessity to expand from the development of Pearl River Delta Urban Agglomeration to the construction of Guangdong-Hong Kong-Macao Greater Bay Area. The research group compared the ACEP index of Pearl River Delta Urban Agglomeration with that of the

Greater Bay Area including Hong Kong and Macao, and found that the ACEP of the whole region increased after incorporating the Greater Bay Area. Figure 14 shows this situation visually. In 2015, if Hong Kong and Macao were excluded, the score of integration index of nine cities in Pearl River Delta would be 61.58, and it would rise to 67.94 if Hong Kong and Macao were included. Different from the decline of the regional integration index due to the incorporation of Zhangjiakou and Chengde and other cities into Beijing-Tianjin-Hebei Urban Agglomeration, the integration index of the whole Greater Bay Area actually increased after Hong Kong and Macao were included. This kind of improvement is not accidental. As a pilot zone of reform and opening up, the development of Pearl River Delta is closely related to its adjacency to world economic nodes like Hong Kong and Macao.

It can also be seen from Figure 14 that if only nine cities in Pearl River Delta were taken into consideration, the integration of this region had slowed down and had become more stable after 2012. **But after Hong Kong and Macao were included, in fact, the regional integration was accelerated.** This trend appeared before the central government issued *The Development Plan Outline for Guangdong-Hong Kong-Macao Greater Bay Area* and reflected the necessity and rationality for China to promote the construction of Guangdong-Hong Kong-Macao Greater Bay Area.

Figure 14: Comparison of Integration of Pearl River Delta and That of Guangdong-Hong Kong-Macao Greater Bay Area



珠三角 ACEP（原始）	Pearl River Delta ACEP (original)
珠三角 ACEP（包括港澳）	Pearl River Delta ACEP (including Hong Kong and Macao)

An investigation of the ACEP index and its decomposition results in nine cities in Pearl River Delta region shows that the fiscal expenditure gap in Pearl River Delta region expanded as a whole from 2006 to 2015. Although it increased by less than 5% in the past decade, it was the only one with regional fiscal expenditure expansion among the twelve urban agglomerations. This is a warning signal.

iii. Yangtze River Delta Urban Agglomeration

Compared with other urban agglomerations in China, Yangtze River Delta Urban Agglomeration has the following characteristics: First, it has the largest economic aggregate, accounting for 20.12% of Chinese economic aggregate; second, it has

the largest population, accounting for 10.98% of the total population in China. It is significantly higher than that of other urban agglomerations except Central Henan Urban Agglomeration (10.44%) and has abundant human capital; third, its geographical space is relatively ample, which accounts for 2.22% of the total land area, is nearly four times the size of Pearl River Delta Urban Agglomeration, is equivalent to that of Beijing-Tianjin-Hebei Urban Agglomeration (2.24%) and is smaller than that of Urban Agglomeration on The West Side of The Straits (2.85%%), Central Henan Urban Agglomeration (2.72%), Harbin-Changchun megalopolis (2.51%) and Chengdu-Chongqing City Group (2.50%).

Further analysis shows that: First, the economic density of Yangtze River Delta region is in the forefront. In 2015, the economic output of Yangtze River Delta region per square kilometer reached 5,945 yuan, which was only less than that of Pearl River Delta (10,308 yuan), about twice that of Beijing-Tianjin-Hebei Urban Agglomeration (3,155 yuan) and six times that of Harbin-Changchun megalopolis. Second, its relative population density and growth are among the highest in China. In 2015, this region accommodated 10.98% of the national population with a land area of 2.22%, and its relative population density reached 4.95, ranking in second place. It increased by 0.47 from 2006 to 2015 and was merely second to that of Pearl River Delta (1.21) and higher than that of Beijing-Tianjin-Hebei Urban Agglomeration (0.36) and that of other urban agglomerations (-0.14-0.14). Third, the population absorption capacity of economic growth ranks the third among twelve urban agglomerations. From 2006 to 2015, the elasticity coefficient of the population proportion to economic proportion in Yangtze River Delta region was only second to that in Pearl River Delta (0.97) and that in Beijing-Tianjin-Hebei Urban Agglomeration (0.68) and was significantly higher than that of other urban

agglomerations.

From the perspective of ACEP index, although the integration level of Yangtze River Delta Urban Agglomeration ranks in the first echelon, it also faces its own prominent problems. First, the regional integration advancement speed of Yangtze River Delta Urban Agglomeration is at a relatively slow speed. In the past decade, the absolute value of the integration index of Yangtze River Delta Urban Agglomeration increased by 22.18, only second to that of Pearl River Delta Urban Agglomeration (25.06). But the relative increase margin was only 64.10% and ranked the fourth-lowest. The integration speed of other urban agglomerations was fast, which was partly due to low starting point while Pearl River Delta Urban Agglomeration still increased by 68.61% from high starting point. This indicates that Yangtze River Delta Urban Agglomeration still has much room for improvement.

Second, the overall level of connectivity of Yangtze River Delta region is relatively high, but the improvement has been limited and inadaptable to its economic development level since the financial crisis in 2009. In 2015, the passenger traffic volume and freight traffic volume of Yangtze River Delta region respectively accounted for 14.28% and 15.47% of those of the whole country, ranking first in the county but lower than its economic share in the country. The proportion of passenger traffic volume was lower than 17.51% of pre-crisis peak value. The proportion of freight traffic volume slowly rebound since 2012 (14.05%) but was still lower than 15.60% in 2006.

Third, the gap of economic level within Yangtze River Delta region is small, but

the difference of fiscal expenditure between governments is large. From 2006 to 2015, the Gini coefficients of internal GDP per capita (taking prefecture-level cities as the unit) in eleven urban agglomerations except Shandong all shrank, among which that of Yangtze River Delta region shrank from 0.248 to 0.196. Its regional economic equalization level ranked the fifth. Seen from the Gini coefficient of per capita fiscal expenditure, the equalization level of public fiscal expenditure in Yangtze River Delta region is relatively low and is only higher than that of Beijing-Tianjin-Hebei Urban Agglomeration, ranking the second-lowest. This reflects the prominent obstacles in system and policy coordination.

On the whole, the regional integration of Yangtze River Delta has made positive progress and has laid a solid foundation. However, if compared with other urban agglomerations (especially Pearl River Delta Urban Agglomeration), there is still obvious room for improvement. Efforts also need to be made in the following aspects: (1) Prioritize the improvement of regional connectivity. The regional connectivity of Yangtze River Delta does not match with its economic status and population status, let alone that of Pearl River Delta. It is necessary to further strengthen the interconnection of intra-regional transportation infrastructure, especially to strengthen the connection between hub cities such as Hefei, Xuzhou, Bengbu, Hangzhou and Nanjing, and to improve water, land and air combined transport system.

(2) Strengthen economic agglomeration and enhance regional economic density. It is necessary to further accelerate the pace of industry transformation and upgrading, make good use of the advantages including active new economy, strong scientific and technological innovation foundation, relatively abundant

private capital and human capital and big industry layout space within the region. At the same time, it is necessary to grasp the opportunity of the expansion of Shanghai Pilot Free Trade Zone, improve the level and quality of foreign capital utilization, strengthen regional economic activities and population absorption capacity and achieve higher quality and faster growth.

(3) Optimize regional industry layout and collaborative division of labor. Yangtze River Delta has a good market foundation, and the core area composed of Shanghai, southern Jiangsu and Hangzhou-Jiaxing-Huzhou area has a high degree of balanced development. But Anhui and northern Jiangsu still have prominent weakness. For industrial spatial layout in the future, this gap shall be taken into key consideration and the resource endowment advantages of these regions shall be given full play to. Factor allocation under marketization shall be speeded up by relying on infrastructure interconnection. In addition, it is necessary to strengthen the convergence and integration of relevant regional planning (especially urban planning).

(4) In terms of policy coordination, mainly consider the financial sharing in the process of industrial transfer, improve the level of regional financial equalization and promote regional public service equalization and institutional linkage on this basis. In addition, national strategies such as the construction of Yangtze River Economic Belt shall be relied on to strengthen the vertical transfer payment to the region as well as the horizontal transfer payment within the region in environmental protection and other fields.

V. Conclusions and Suggestions

On the whole, China's urban agglomerations are rising rapidly, and the number and scale are unprecedented. The rise of cities and urban agglomerations also brings new forms of urbanization. Population and economic activities are increasingly concentrated in urban agglomerations on a global scale. This report calculates the level of regional integration of China's twelve urban agglomerations. Based on the above-mentioned findings, here are some suggestions for promoting the integration of large urban agglomerations:

First, the twelve urban agglomerations will serve as the main platforms and breakthrough points for balancing urban and rural development and regional development and improving the quality and efficiency of China's economy in the next stage. We shall practice the five development concepts with urban agglomeration as the carrier. The integrated development of these urban agglomerations will provide greater space for structural reform in other regions. Among them, special attention shall be paid to the construction of economic circle of three major bay areas including the Bohai Rim, Yangtze River Delta and Guangdong-Hong Kong-Macao Greater Bay Area.

Second, a priority shall be given to the improvement of the population absorption capacity of large urban agglomerations. Beijing-Tianjin-Hebei Urban Agglomeration, Yangtze River Delta region and Pearl River Delta region have large economies and strong employment-absorbing capacity. We shall give full play to the overall advantages of the three urban agglomerations in overall population absorption and optimize the regional population distribution according to the principle of "large concentration and small dispersion" at the same time. We shall speed up the reform of household registration system as well as the

supporting public service system in four urban agglomerations including Central Plains, Chengdu-Chongqing City Group, Guanzhong Plain and Harbin-Changchun megalopolis, improve their ability to absorb the surrounding population, and relax the household entry threshold for big cities with less than 10 million residents.

Third, we shall regard economic equalization and policy coordination (fiscal expenditure equalization) as two driving forces to promote integration. In particular, it is of particular urgency for Beijing-Tianjin-Hebei Urban Agglomeration. It is necessary to expand the horizontal financial transfer payment of the central government to Beijing, Tianjin and Hebei province, take advantage of the historic opportunity of the construction of Xiongan New Area and narrow the gap in financial capacity and expenditure within the region. The integration level of Central Plains, Harbin-Changchun megalopolis, Guanzhong Plain, Changsha-Zhuzhou-Xiangtan and other urban agglomerations is relatively low but the gap of internal public fiscal expenditure is small. Therefore, it is necessary to seize the opportunity to establish a regional integrated public service system.

Fourth, we shall take Central-southern Liaoning and Harbin-Changchun urban agglomerations as the center to lead the revitalization of northeast China and give full play to the leading role of Central-southern Liaoning Urban Agglomeration. It is suggested that a strategic reform pilot zone shall be set up in Central-southern Liaoning and Harbin-Changchun megalopolis as a breakthrough point for the revitalization of northeast China in the next stage.

Fifth, we shall closely watch and evaluate the influence of monetary policy and

public investment on integration. We shall make credit and fiscal policies more targeted, promote infrastructure connectivity within urban agglomerations, take effective measures to reduce logistics costs, and create favorable conditions for the flow of people, capital and goods within the region.