A COMPREHENSIVE EVALUATION OF URBANIZATION LEVEL IN FUJIAN PROVINCE OF CHINA

Lijie Lin and Jianfa Shen
Department of Geography and Resource Management
Research Centre for Urban and Regional Development
The Chinese University of Hong Kong, Shatin, NT, Hong Kong
E-mail: lijielin@cuhk.edu.hk; jianfa@cuhk.edu.hk

Abstract
To move beyond the demographic urbanization level, the present study attempts to develop an integrated indicator, namely comprehensive urbanization level, to evaluate the comprehensive developing level of urbanization in county-level areas in Fujian province by taking various aspects into consideration. The analyses have three parts. First, the relationships between demographic urbanization level and other selected indicators regarding economic and social development were detected by correlation analysis. Second, an integrated indicator of urbanization level was derived by using principle component analysis. Finally, the spatial disparity of integrated urbanization level in Fujian Province was revealed by clustering analysis and discriminant analysis. The urbanization level of Fujian is further categorized as five gradient clusters of very high, high, medium, low and very low urbanized units.

Introduction

Under the background of economic globalization, China's urbanization has attracted widespread attention. Joseph E. Stiglitz, Nobel laureate in economics, once said that urbanization of China, together with high-tech development in the United States, are two key issues which will reshape the world in the 21st century (Wu, Wu and Wu 2003). As a milestone of the national urbanization process, China's urbanization level, i.e., the proportion of urban population in total population, crossed the 50% threshold for the first time in 2011. However, a broadly defined urbanization process involves not only population growth, but also economic development and environment change. The proportion of urban population in total population cannot capture the full process of urbanization.

Internationally, due to the lack of uniform definition of cities and towns, the term of urbanization could not be commonly evaluated by normative statistical caliber. For China, using the demographic indicator of urbanization level to assess the urbanization process has following two limitations:

(1) The demographic urbanization level is sensitive to the definition of city and urban population. Owing to the changing and confusing definition of urban area and

the inconsistent statistical criteria of urban population in China, terms like “riddle”(Orleans and Burnham 1984), “enigma”(Orleans and Burnham 1984, Shen and Swansea 1995) and “the statistical mystery in China” (Yan, Lin and Xu 1994) have been frequently used by Chinese as well as Western scholars to describe China’s urban population size and the corresponding index, namely, demographic urbanization level. Additionally, China’s household registration (*hukou*) system makes the situation even more complicated.

(2) Demographic urbanization level only focuses on the nominal population size without considering the quality of urbanization. The term of “new form of urbanization” has been proposed in China to reflect the goal of a balanced urbanization path to ultimately achieve rural-urban integration, including the convenient provision of urban public services and facilities, the equality of social welfare and educational opportunities, the coordinated development of spiritual civilization along with material civilization, *etc* (China Development Research Foundation 2013).

There have been numerous studies which outline the relationship between demographic urbanization and other socioeconomic effects in China (Henderson 2003, Abdel-Rahman, Safarzadeh and Bottomley 2006, Sun, Yan and Liu 2009, Kilkenny 2010, Wang 2010, Bai, Chen and Shi 2011, Chan 2012, Shen, Feng and Wong 2006). Using qualitative methods, the interactions of urbanization and these relevant socioeconomic effects have been well discussed in previous studies. Additionally, some scholars dedicated themselves into the study of China’s urbanization using statistical methods (Fan and Tian 2003, Liu 2004, Fang and Liu 2009, Chen et al. 2014). They have obtained useful results: (1) It is found that there is significantly spatial disparity in urbanization and economic development especially between the west and the east in China (Liu 2004, Fan and Tian 2003, Fang and Liu 2009, Chen et al. 2014). In addition, the spatial pattern has been changing over time. For example, Liu (2004) found that the provincial disparity of urbanization has changed from the north-south pattern to the present east-west one since the 1990s. Fang and Liu (2009) found that the provincial disparity began to narrow while there was little change in inter-regional disparity. (2) Some studies focused on the relationship between urbanization and other natural, social and economic factors. They emphasized the important role of economic indicators such as nonagricultural employment structure, industrialization level and per capital GDP in the process of urbanization (Fan and Tian 2003, Liu 2004, Chen et al. 2014).

However, most of them studied the urbanization process using statistical models at national or regional scale. The relationship between economic development and urbanization process have also been highlighted. But the role of other factors related to social development has been neglected.

To move beyond the demographic urbanization level, the present study attempts to develop an integrated indicator, namely comprehensive urbanization level, to evaluate the comprehensive developing level of urbanization in county-level areas in Fujian province by taking various aspects into consideration. The analyses have three parts. First, the relationships between demographic urbanization level and other

selected indicators regarding economic and social development were detected by correlation analysis. Second, an integrated indicator of urbanization level was derived by using principle component analysis. Finally, the spatial disparity of integrated urbanization level in Fujian Province was revealed by clustering analysis and discriminant analysis. The urbanization level of Fujian is further categorized as five gradient clusters of very high, high, medium, low and very low urbanized units.

The rest of the paper is organized as follows. The next two sections introduce the study area and the methodology respectively. This is followed by the main results of analysis. The final section concludes the paper.

Research Background: Urbanization and Development in Fujian

Fujian province is located in the southeast coastal area of China with a total area of 0.124 million square kilometers. According to the 6th national population census in 2010, Fujian had a total population of 36.9 million, including temporary population of 11 million. The temporary population grew dramatically by 87% in the period 2000-2010 (FPC 2013). As shown in Fig.1, Fujian province consists of 9 prefecture-level cities in 2010. They are divided into 67 county-level area units, including 9 urban areas of prefecture-level cities (*diji shi*), 14 county-level cities (*xianji shi*) and 45 counties (*xian*, excluding Jinmen which is under control of Taiwan).

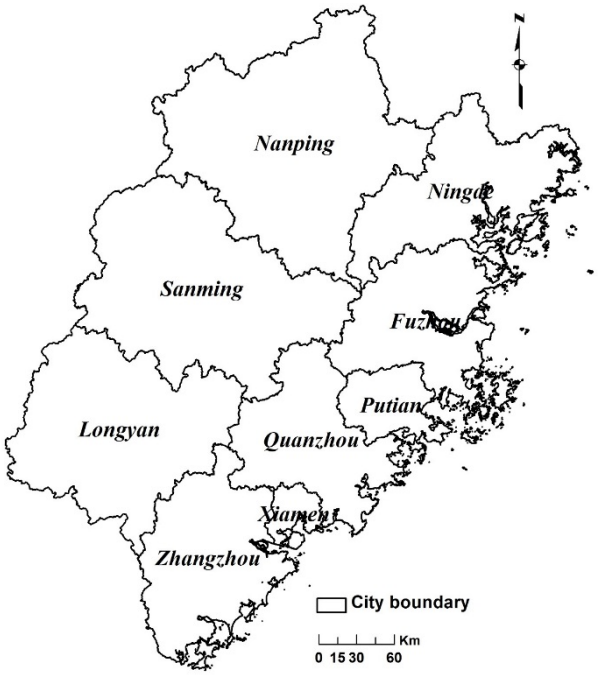

Figure 1. Prefecture-level Cities of Fujian Province

In terms of socioeconomic development, like the Pearl River Delta and the

Yangtze River Delta, Fujian has also been at the forefront of reform and opening since 1978. From the perspectives of comprehensive economic strength, city size or population size, although Fujian province lagged far behind Pearl River Delta and the Yangtze River Delta which have been considered as the most prosperous, vigorous and open economic regions in China, it has a distinct path of urbanization process that has consequently attracted the attentions of some scholars (Chen 2006, Zhu 1998, Zhu et al. 2013, Tan and Ding 2008). Additionally, a key strategy of developing Western Taiwan Strait Economic Zone was proposed in 2004. It is expected that there will be more and more opportunities and challenges not only for Fujian province, but also for those neighboring regions or provinces as well. A comprehensive evaluation of the urbanization level in Fujian is timely and significant.

Methodology and Conceptual Framework

Many attempts have been made to conceptualize the dynamic mechanism of China's urbanization (Ma and Lin 1993, Ma and Fan 1994, Sit and Yang 1997, Zhu 1998, Ning 1998, Shen, Wong and Feng 2002). It is well known that urbanization is an interdisciplinary issue, involving population growth, economic development, social progress, *etc*. However, the core issue is essentially population. Based on the concepts of dual-track urbanization, a conceptual framework of comprehensive urbanization level is proposed from the perspectives of population, economy and society. This will be used in this study and is shown in Fig. 2.

Owing to *hukou* system and strong role of the government, the urbanization process in China is unique and clearly different from most Western developed countries. All citizens in mainland China are classified by two categories according to the conditions of residential location and socioeconomic eligibility (Chan and Zhang 1999). The former category is the place of *hukou* registration (*hukou suozaidi*). The latter one is the status of *hukou* registration (*hukou leibie*), further classified as agricultural and nonagricultural *hukou* (Chan and Zhang 1999). Based on *hukou* system, the concept of dual-track urbanization has been proposed to describe China's urbanization in the reform period (Shen et al. 2002). It has two tracks of "state-sponsored urbanization" and "spontaneous urbanization". The track of state-sponsored refers to the growth of nonagricultural population in urban area while that of spontaneous refers to the rural urbanization driven by township and village enterprises (TVEs, private enterprises nowadays) and the rural-urban migration of temporary population (Shen et al. 2002, Shen et al. 2006).

With rapid processes of decentralization, marketization and globalization, the importance of state-owned sector is progressively declined in China's transitional economy (Lin 2001, Wei 2001, Shen 2004, OECD 2000). Non-state sectors have played an increasingly significant role in the economic growth during the past two decades (OECD 2000).

Based on the ownership, China's enterprise sectors could be divided into four main classes: state-owned enterprises (SOEs); collectives involving TVEs in rural areas and co-operatives in urban areas; foreign-funded enterprises; and private

enterprises (OECD 2000). It is noted that many collective TVEs have been converted into private enterprises in recent years. In fact, the relationship between urbanization and economic growth could be concisely described as follows. Many job opportunities provided by different economic sectors could be considered as the driving force of economic development and population concentration. Population concentration leads to the expansion of urban size. Due to agglomeration economies in production sectors of urban areas, productivity and wage rate may improve significantly. That further promotes the economic development. Therefore, more and more job opportunities are being created and further promotes population concentration.

However, the urbanization process not only means population growth and economic development from the perspective of quantity, but also connotes the improvement in quality. The development of basic public service is essential for the good quality of social life. In fact, *hukou* is the bond between population and social basic public service. *Hukou* essentially acts as social welfare allocation system in China especially in pre-reform period (Chan and Zhang 1999). Although the relaxed policy of population migration and employment makes population movement more spontaneous in reform China, the *hukou*-based disparity of entitlements still exists in social life. The discrimination caused by different *hukou* status involves agricultural vs. nonagricultural and local vs. nonlocal. The rural-urban migrants often occupy in the labor-intensive sectors which are reluctant to be undertaken by urban residents. No matter how long they work and live in urban areas, without local *hukou*, they are still labelled as ‘peasant workers’ (*nongmin gong*) and could not enjoy the equivalent entitlements to urban locals (Chan 1996). For example, they face problems of schooling for migrant workers’ children in urban areas and employment discrimination against migrant workers in urban areas.

On the relationship between economy and basic public service, it is well accepted that the development of basic public service are determined largely by the level of regional economic development. The improvement of basic public service is mainly realized through the fiscal capacity of the state and the local government (Teng and Lin 2012). In a word, from the aspects of quantity and quality, urbanization could be considered as a comprehensive system with rapid interactions between population growth, economic development and social changes.

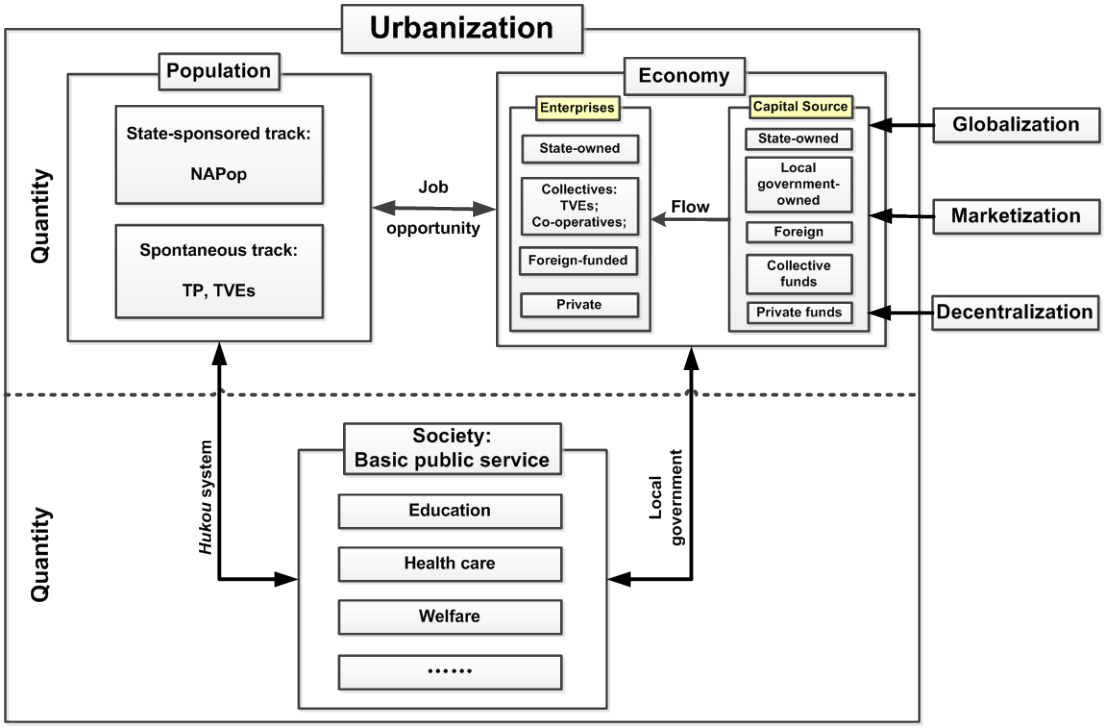

Figure 2. Conceptual Framework of Comprehensive Urbanization Level

Considering the availability and validity of data, totally 18 indicators (as Tab. 1) were selected to reflect dual-track urbanization process in Fujian province. They are divided into 3 categories which represent the levels of population growth, economic development and social basic public service respectively. The role of each indicator in the comprehensive urbanization level is discussed in the following.

The first category is population indicators. The indicator of NAP (see definition in Tab. 1) reflects the track of state-sponsored urbanization, while that of TP indicates the spontaneous one. The indicator of PD reflects the process of population concentration involving both tracks of state-sponsored and spontaneous. From the perspective of employment structure, the indicator of STemp also manifests these two tracks. State-sponsored urbanization could be represented as nonagricultural population occupied in nonagricultural sectors. Spontaneous urbanization could be detected as agricultural population which appears as temporary population in urban areas or agricultural population occupied in the nonagricultural sectors like TVEs in rural areas without rural-urban migration.

The second category is economic indicators. In the reform period, China has adopted the partial and gradual ways of restructuring the economic system of financial decentralization and the management of state property, including housing and land (Wu 1997). Thus, the indicators of PGDP, LFR and RSCG represent the general economic strength induced by state, local government, as well as spontaneous market behavior. The indicators of S_GDP, S_FAI, T_GDP and T_FAI highlight the economic structures of secondary and tertiary in the urbanization process.

The third category is social indicators. They reflect the ability of state or governments providing social basic public service, including welfare, education, health care, *etc*. Among the 7 social indicators, HEdu, TeachS and Stu represent the

popularized degree of primary education and the level of education service, MedicalS and HBedspace indicate the capacity of medical service and the concern and investment from government, EI and MI show the developing level of basic social security and basic medical security.

TABLE 1 INDICATORS FOR COMPREHENSIVE URBANIZATION LEVEL EVALUATION

Category	Indicators	Minimum	Maximum	Average
Population indicators	***NAP*:** Share of nonagricultural population in total population (%);	10.08	83.49	39.06
	***TP*:** Share of temporary population in total population (%);	30.02	60.92	30.02
	***PD*:** Population density (persons per square km);	59.62	4067.07	298.00
	***STEmp*:** The share of secondary and tertiary industries in employment (%);	27.38	97.50	3.79
Economic indicators	***PGDP*:** Per capita GDP (thousand RMB/person);	13.96	61.86	40.03
	***LFR*:** Per capita Local fiscal revenues (thousand RMB/person);	0.52	8.19	2.85
	***RSCG*:** Per capita retail sales of consumer goods (thousand RMB/person);	4.50	40.39	14.53
	***S_GDP*:** Share of second industry in GDP (%);	20.36	65.11	51.05
	***S_FAI*:** Share of second industry in fixed asset investment (%);	8.48	80.85	35.02
	***T_GDP*:** Share of tertiary industry in GDP (%);	16.80	62.48	39.70
	***T_FAI*:** Share of tertiary industry in fixed asset investment (%);	17.04	88.87	63.12
Social indicators	***HEdu*:** Ratio of employed population with higher education (person/1, 000 persons);	19	125	53
	***TeachS*:** Ratio of teaching staff in primary and secondary education (person/1, 000 persons);	5	16	8
	***Stu*:** Ratio of students in primary and secondary education to population (person/1, 000 persons);	88	178	117
	***MedicalS*:** Ratio of medical-related staff to population	2	15	7

	(person/1, 000 persons);			
	HBedspace**:** Ratio of hospital beds to population (set/1, 000 persons);	1	6	3
	EI**:** Coverage of endowment insurance (%);	3.41	36.72	13.46
	MI**:** Coverage of medical insurance (%);	3.66	40.95	14.14

Sources: Derived from Fujian Statistical Yearbook 2011 (FSB 2011), Fujian Office for Population Census 2013 (FPC 2013)

Specifically, the analysis of comprehensive urbanization level included three major steps (as Fig. 3). First, the relationships between demographic urbanization level and other selected indicators regarding economic and social development were detected by correlation analysis. Second, an integrated indicator of urbanization level was derived by using principle component analysis. Three principle components without overlapping information were extracted from various socio-economic variables. Finally, the spatial disparity of integrated urbanization level in Fujian Province was revealed by clustering analysis and discriminant analysis. Additionally, the urbanization level of Fujian could be further categorized as five gradient clusters of very high, high, medium, low and very low urbanized units from the point of view of statistical significance.

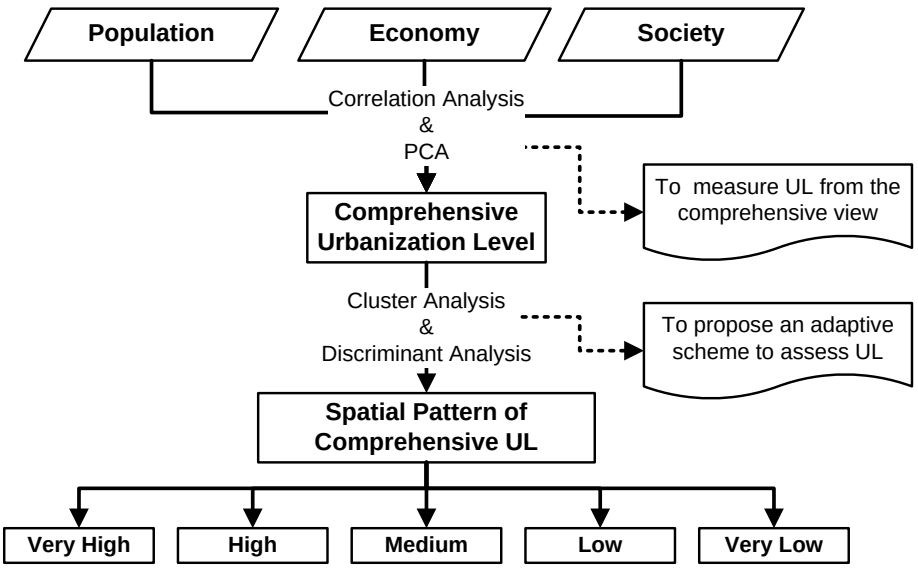

Figure 3. Flow of Comprehensive Assessment of Urbanization Level

Results and Discussion

Demographic urbanization level and socio-economic development

According to the result of correlation analysis, demographic urbanization level was highly correlated with 7 variables of NAP, TP, HEdu, LFR, STEmp, RSCG and EI (as Tab. 2). The Pearson correlation coefficients were all over 0.6, and the results were significant at the 0.01 level with two-tailed test. However, owing to partial correlation existed among these variables, it is necessary to use principle component analysis to alleviate the degree of multiple collinearity.

TABLE 2. CORRELATION OF DEMOGRAPHIC URBANIZATION LEVEL WITH 7 VARIABLES

	NAP	TP	HEdu	LFR	STEmp	RSCG	EI
UL Pearson Correlation	0.657**	0.768**	0.611**	0.629**	0.673**	0.622**	0.609**
Sig. (2 tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

Comprehensive urbanization level

Principle component analysis effortlessly reduces the mass of confusing information into a relatively small number of uncorrelated components that account for most of the observed variance (Field 2009). Total 18 indicators were considered as variables in the process of principle component analysis. Finally, three major components were extracted, and the cumulative variance was 79.124% of total variance. Once all significant loadings were identified, each component was named based on the patterns of the component loadings (as Tab. 3).

The first component was associated with the variables involving population (NAP; TP; PD; STEmp), economy (PGDP; LFR; RSCG), and society (HEdu; MedicalS; EI; MI). These variables comprehensively reflect the urban development and life quality. The first component could be named as urban modernization level. It contributes to 50.614% of total variance. With regard to the second component, the variables of TeachS (Ratio of Teaching staff to students in primary education), Stu (Ratio of students in primary education to population) and HBedspace (Ratio of hospital beds to population) had relatively high loading. All of these showed the development of science, education, health and other social undertakings. Therefore, the second component could be named as urban public service level. It contributes to 15.955% of total variance. As for the third component, it is more correlated with the variables of S_GDP (Share of second industry in GDP), T_GDP (Share of tertiary industry in GDP), S_FAI (Share of second industry in fixed asset investment) and T_FAI (Share of tertiary industry in fixed asset investment). Obviously, these variables belonged to economic indicators, especially the proportion of second and tertiary industry. Thus, it could be named as urban economic development level. It contributes to 12.579% of

total variance.

TABLE 3 PRINCIPLE COMPONENTS EXTRACTION

Component	Eigenvalue	% of Variance	Variables
1 (Urban modernization level)	9.111	50.614	NAP; TP; PD; STEmp; PGDP; LFR; RSCG; HEdu; MedicalS; EI; MI
2 (Urban public service level)	2.872	15.955	TeachS; Stu; HBedspace
3 (Urban economic development level)	2.264	12.579	S_GDP; T_GDP; S_FAI; T_FAI

Finally, the overall score of each area unit, which represents the comprehensive urbanization level, could be calculated, weighted by relative variance contribution of each component. Tab. 4 showed the order of each component score, overall score and demographic urbanization level.

Urban areas (UA) of prefecture-level cities occupied the majority of top 10 in the score of component 1, urban modernization level. Some county-level cities and counties had higher urban public service level than many urban areas of prefecture-level cities. All of the top 10 area units in component 2 (Urban public service level) were county-level cities and counties under the prefecture level cities of Putian, Quanzhou, Fuzhou and Xiamen. In other words, these 4 coastal prefecture-level cities could provide the relatively higher urban public service than other cities in Fujian. As the secondary and tertiary industries related variables were highly loaded in component 3 (Urban economic development level), all of the top 10 area units in component 3 were county-level cities and counties. However, all of the area units were subordinated to the coastal prefecture-level cities.

With regard to the order of comprehensive urbanization level based on the total component scores, Shishi and Jinjiang were the only two county-level cities that were among the top 10. Due to the prosperity of township and village enterprises, Shishi and Jinjiang were known with the highly developed *in-situ* urbanization in Fujian province (Zhu 2000, Zhu 2002). On the other hand, the ranks of demographic urbanization level and the comprehensive urbanization level are very different. Actually, the comprehensive urbanization level is much closer to the actual urbanization by taking into consideration of other social-economic indicators.

TABLE 4 COMPONENT SCORE AND RANKING

Rank	Component 1	Component 2	Component 3	Comprehen-sive urbanization level	Demographic Urbanization Level
1	Xiamen UA	Jinjiang	Jinjiang	Xiamen UA	Fuzhou UA
2	Fuzhou UA	Putian UA	Changle	Fuzhou UA	Xiamen UA

3	Quanzhou UA	Nan'an	Luoyuan	Quanzhou UA	Sanming UA
4	Zhangzhou UA	Pingtan	Hui’an	Zhangzhou UA	Zhangzhou UA
5	Longyan UA	Anxi	Shishi	Longyan UA	Quanzhou UA
6	Sanming UA	Shishi	Nan'an	Sanming UA	Shishi
7	Shishi	Xianyou	Changtai	Shishi	Dehua
8	Jinjiang	Fuqing	Minqing	Jinjiang	Longyan UA
9	Putian UA	Lianjiang	Longhai	Putian UA	Shaowu
10	Nanping UA	Xiamen UA	Zherong	Nanping UA	Nanping UA

Notes: UA refers to urban area

Spatial disparity of comprehensive urbanization level

With the aid of cluster analysis, individual area units with similar characteristics could be divided into several groups or clusters based on the scores of three principle components. Based on the Euclidean distance used in Ward’s method, five clusters were generated. These five clusters were labelled as areas with very high, high, medium, low and very low levels of urbanization. After getting the prior knowledge of group membership, discriminant analysis was used to verify the accuracy of cluster analysis. The result of cross-validation showed that 65 out of 67 area units were correctly classified. Considering the condition of two units that were not correctly classified, the results of discriminant analysis were closer to the reality and were used. The result is shown in Fig. 4. Tab. 5 showed the average level of comprehensive urbanization.

TABLE 5 THE AVERAGE LEVEL OF COMPREHENSIVE URBANIZATION AMONG FIVER CLUSTERS

Cluster	**Component 1**	**Component 2**	**Component 3**	**Compre-hensive urbanization level**	**Demographic urbanization level**
Very high	8.12	-0.43	-0.75	4.98	84.83%
High	0.72	2.42	2.04	1.27	51.33%
Medium	2.11	-2.26	0.27	0.95	61.80%
Low	-1.88	1.05	-1.60	-1.24	37.27%
Very low	-1.17	-0.74	0.27	-0.86	42.88%

Note: The comprehensive urbanization level is a relative figure. It can be negative as it is based on component scores.

Generally, the comprehensive urbanization level in coastal regions is distinctly better than the inland mountainous regions. Two paralleled longitudinal axes could be found in the coastal and inland regions, centered around Fuzhou, Xiamen and Quanzhou in the coastal region and 3 industrial cities of Nanping, Sanming and Longyan in the inland region, respectively.

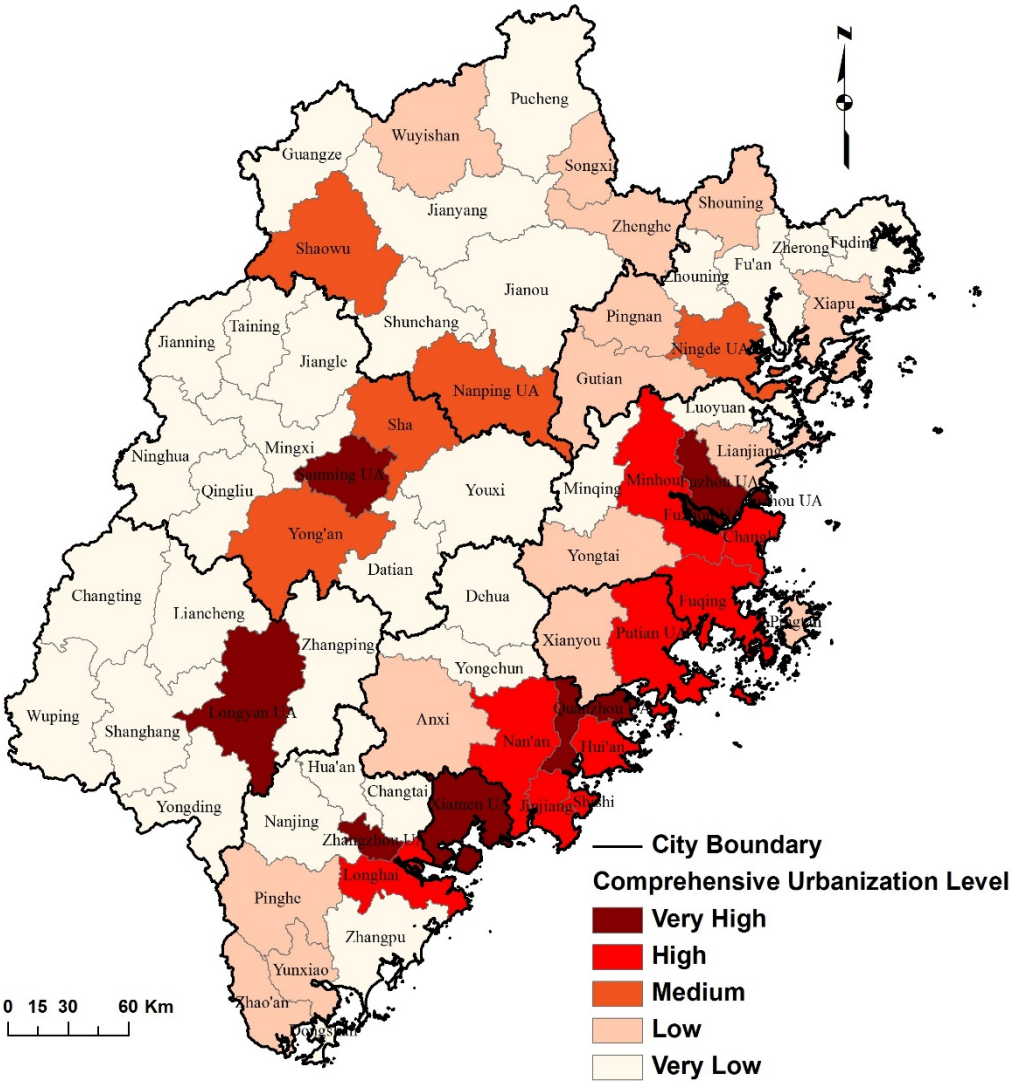

Figure 4. Spatial Disparity of Comprehensive Urbanization Level in 2010

Conclusion

Based on the above analysis using the comprehensive indicator of urbanization level involving population, economy and society, we obtain following results. (1) The urban areas of the provincial capital city Fuzhou and Xiamen Special Economic Zone are two area units with the highest comprehensive urbanization level. (2) Some urban area units have very high comprehensive urbanization level. All county-level units with high comprehensive urbanization level are all subordinated to the prefecture level cities of Quanzhou and Fuzhou. Due to the prosperity of TVEs, these two area units are known for highly developed in-situ urbanization, especially Shishi and Jinjiang. (3) The comprehensive urbanization level in coastal regions is much higher than the inland mountainous regions. (4) The prefecture level city of urban area in Ningde has the lowest comprehensive urbanization level among five coastal cities of

Fujian.

It would be more reliable to use comprehensive urbanization level to measure the urbanization process for a certain region or country. Comparing with the indicator of demographic urbanization level, the comprehensive one is more integrated to unify the literal meaning of urbanization with population, economic and social changes. In other words, urbanization not only is a process of urban population growth, but also represents the development of urban infrastructure, health care, culture, education, and so forth. Additionally, the gap between urban population growth and public service, at the backdrop of unscientific development pattern, could be revealed. Due to the integrated characteristics, the indicator of comprehensive urbanization level is helpful to realize and resolve this discrepancy in the process of rapid urbanization.

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