

The Models of Urbanization and Their Impacts on Spatial Evolution of Built-up Areas—Case Studies of Cities in Shaanxi in Northwest China

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Abstract: Large-scale demographic changes driven by migration are already a fundamental force in urbanization and have different affect on spatial evolution of cities with different scales and different development condition. In Shaanxi, the gap between the household registration population and permanent residents increase gradually. Furthermore, it results in different effectiveness of planning practices, especially, to spatial development and layout because of the uncertainty in population. The paper describes the drivers of regional development, spatial evolutionary course of the built-up areas of the dominant cities, planning practice and their effectiveness etc.. The specific focus is on the relationship between population migration features and spatial evolution of built-up areas by the compared analysis of cities with different scales and different drivers. The results demonstrate that the central Shaanxi has been experiencing the increase of permanent residents. Especially, the mega city-Xi'an- has been experiencing a large number of permanent residents increase from every municipal regions throughout Shaanxi and other regions in Northeast China over the past several decades. For Northern and Southern Shaanxi, the population migration has complex characteristics. Different migration models make different urbanization models as well as different growth and spatial evolution characters of built-up areas of dominant cities. Furthermore, it results in different effectiveness of planning practices

1. Introduction

Nowadays, the bound between migration and population floating is confusion in China because of the more and more separation of residence and household registration place, and there are many terms related to them, such as permanent migration, temporary migration, migration as registered permanent resident, migration without registering as permanent resident, floating population and temporary resident population etc.. Although the statutory migration refers to the migration as registered permanent residence, the migration population in census and sampling survey does not mean that because of the complex and diversity of population migration and floating ^[1]. In this paper the authors use the same concept-including migration as registered permanent resident and residing in another place more than 6 months without registering as permanent resident-as that used in the census and sampling survey.

The migration is an social expression of spatial interaction of original places and destination, and it reflects the regional differences of economy level, investment strength and employment opportunity etc.^[2]. In China, the main migration directions are moving from rural areas to cities of different scales and moving from developing areas to developed areas while there are different characters in different regions. Migration between provinces is characterized by moving from Mid-west to some developed cities in costal areas, and migration within province is characterized by moving from rural areas and small towns and cities to the dominant cities and industries areas. What's more, the phenomenon of migrate workers intensify the diversity and complexity of population migration in China. Furthermore it results in the transformation and transition of urban and rural structure. Large-scale

demographic changes driven by migration are already a fundamental force in urbanization and have different affect on spatial evolution of cities with different scales and different development condition. Based on regional survey of Shaanxi province in Northwest China and case studies of Xi'an (in Central Shaanxi), Yulin (in Northern Shaanxi), Ankang (in Southern Shaanxi)), which has different development condition and bases, this paper explores the models of urbanization and their impacts on spatial evolution of regional dominant cities, especially the relationship between population migration features and spatial evolution of built-up areas by the compared analysis of cities in different regions with different scales and different drivers.

2. The basic characters of three regions in Shaanxi

Shaanxi province is located in Northwest China, and is divided into three geographical unit—loess plateau in Northern Shaanxi with rich mineral resources such as coal, oil, gas and salt mine resources, and Plain in Central Shaanxi with good location and development base, and Qinling Mountains and Ba Mountains in Southern Shaanxi with important eco-protection position and water resources.

2.1. Northern Shaanxi

The region borders western Shanxi province in the east with Yellow River in the middle of them, adjacent to Gansu province and Ningxia with the meridian ridge as boundary in the west, neighbor with Inner Mongolia in the North and connected with Tongchuan city of Guanzhong Plain in the south. Its scope includes Yulin and Yan'an administration areas which has 25 counties in all. Its total area is 93,000 square kilometers and its total population is 5546400 peoples. The dominant cities are Yan'an and Yulin city. The basic landform is loess tableland, beams, hilly, ditch, Plateau. The main industries in this area are energy carriers industry, coal making oil, coal-salt chemical, petrochemical. The Yulin and Yan'an are the services bases for immediate counties with leading secondary industries while the city proper mainly develops tourism, tertiary industry, and light industry. Shaanxi. Energy and chemical base in northern Shaanxi is approved as China National Energy and Chemical Base in 1998, and it is also one of the regions with rapid economic development since the late of 20 century in Shaanxi.

2.2. Guanzhong Plain

Guanzhong Plain, sits in central Shaanxi. It's the most prosperous place in Shaanxi province. Guanzhong Plain is close to Qinling Mountains in the south and neighbor with the Loess Plateau in the north. It includes five municipalities, such as Xi'an, Baoji, Xianyang, Weinan, Tongchuan and Yangling District. The resident population of Guanzhong Plain is 23497700 and its area is about 34,000 square kilometers. Guanzhong Plain is the main production base of grain, cotton, oil plants and high-quality fruit base in Shaanxi. What's more, it is also the most important industrial base in Shaanxi Province, and it has been formatted a relatively complete industrial system of agriculture, textiles, electronics, coal, petrochemical, machinery and equipment manufactory, energy etc., especially in the equipment manufacturing industry and high-tech industrial development with five different levels of high-tech development zone, where three is at the state-level. Guanzhong plain is the important research base for national aerospace, aviation, machinery, electronics, instruments etc..

2.3. Southern Shaanxi

Southern Shaanxi contains Hanzhong, Ankang and Shangluo three administration areas which have 25 counties in all, and dominant cities are Hanzhong, Ankang and Shangluo city. The resident population is 8382000 by the end of 2011 and has a total area of 70,200 square kilometers. Sorthern Shaanxi is extremely rich in water, heat, forest, grass resources and local products, mineral and other natural resources, and it also very rich in hydropower

resources since it is the birthplace of the Han River which is the largest tributary of the Yangtze River. In recent years, southern Shaanxi has concentrated on the building the core of circular economy gathering area, and formed the new ideas of developing three leading industries of bio-processing, eco-tourism, and new materials. The population density is sparse compared with the Guanzhong Plain because of the natural condition limit, and it is the radiation source of population migration. Table 1 shows the basic Characters of three major regions in Shaanxi Province.

Table 1. The basic Characters of three major regions in Shaanxi Province

Regions	Total population	Total area (square kilometer)	Dominant city	Major industry
Northern Shaanxi	5, 546, 400	93,000	Yulin, Yan'an	Agriculture, energy and Chemical Industry etc..
Guanzhong Plain	23, 497, 700	34,000	Xi'an, Baoji, Xianyang, Weinan, Tongchuan, Yangling District	High-Tech Industry. Modern Equipment & Manufacturing Industry, Tourism etc.
Southern Shaanxi	8, 382, 000	70200	Hanzhong, Ankang and Shangluo	Biological processing, Ecotourism, New materials, etc.

3. The population migration Characteristics of Shaanxi

The regional distribution of population in Shaanxi Province is significant differences, and display the features of dense population in Central Shaanxi and sparse in the North and South. According to the Sixth Census, the resident population of the Central Shaanxi, Southern Shaanxi and Northern Shaanxi accounted for 62.69%, 22.47% and 14.84% respectively. In terms of the population distribution of administration areas, compared with the year 2000, the population proportion in some rapid socio-economic growth areas, such as Xi'an, Yulin, Yan'an and Yangling have increased to varying degrees, especially in Xi'an, the population proportion of the province rose from 20.56% in 2000 to 22.69% in 2010, increased by 2.13%. The features of dense populated in central Shaanxi and sparse in the North and South Shaanxi become more striking.

Table 2 demonstrates the migration within province is much larger than between provinces and the ration of migration population to residence population is increase rapidly with the social and economic development.

Table 2 The migration ratio in census in Shaanxi Province

Time	The ratio of migrate people to total residence population (%)	The ratio of migration between provinces to total migration (%)	The ratio of migration within province to total migration (%)
1990	0.3	30.59	69.41
1995	1.4	29.95	70.05
2000	7	18.01	81.99

Sources: the fourth and fifth census and sampling survey

The number of migration population is large, and the trend that the population from rural to urban area, and from less developed areas to economically invigorating regions and big cities is more prominent. According to the Fifth Census data, at 0:00 on November 1st, 2000, the residence population was 36,050,000 in Shaanxi province, and migrated population was 3,405,600, accounted for 9.5%; and the migrants lived mainly in Xi'an, Weinan, Xianyang and Baoji (four cities occupied 58%), as illustrated in figure 1. The migrants were born inside the province mainly choose to live in Xi'an(19%)、Weinan(15%)、Xianyang(14%)、and

Baoji (10%) and the migrants born outside the province mainly choose to live in Xi'an(49%)、Weinan(9%)、Xianyang(11%)、and Baoji (12%) too. The main reasons of population migration in Shaanxi Province are as follows: study, business, marriage, moving, employment, job transfers and seek help with relatives and friends in addition to the large amount of rural surplus labor and the great income gap between urban and rural area. Xi'an has excellent resources for primary and secondary education, and many universities gathered here, which attract those who from Northern Shaanxi and Central Shaanxi want the best education for their children. They purchase house and send their children to school in Xi'an. They mainly choose the central area and suburb of Xi'an to settle down where have educational resources, and migrate follows the chain migration patterns. The chain migration is the most common mode in China. The Social Relations Network has become the main factor of location choice for present China's floating population. Migrants make the decision and get the information about the new places from kinship, village relationship and interpersonal relationship net, rather than from the government and the market. On November 1st, 2010, the floating population of Shaanxi for 5,894,400 people, accounted for 15.79% of residence population, compared with 2000, the floating population increased by 1.5 times, accounted for the proportion of the residence population advanced 9.1 percentage point. 60.1% of the people from other provinces to live, work, study and trade in Xi'an, 12% in Yulin for natural resources development. The outflow population of the region in Shaanxi can be viewed that Southern Shaanxi took up almost half of the migration, Hanzhong and Ankang accounted for 23.93% and 19.45% respectively of the Southern Shaanxi; Xianyang, Weinan and Baoji accounted for 12.11%,10.95% and 9.01% respectively of the Central Shaanxi, and these five cities occupied 75.45% of the total outflow population. For the situation of population migrating in the province, intercity floating population was 1,015,200, more than 80% fixed upon the Xi'an as a migrant destination.

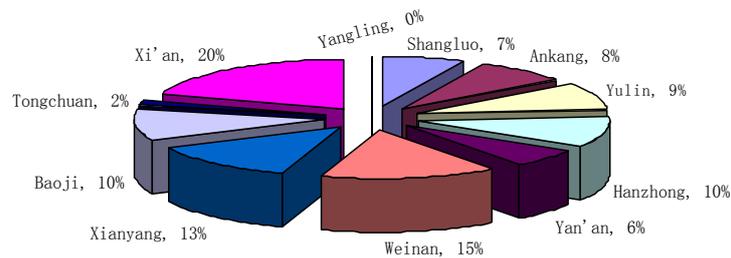


Figure 1. The distribution of immigration of Shaanxi in 2000

Figure 2 shows the number change of residence population in different administration areas according to the fifth and sixth census, and it demonstrates that the residence population of Xi'an, Baoji, Yan'an and Yulin increase while that in other administration areas decrease.

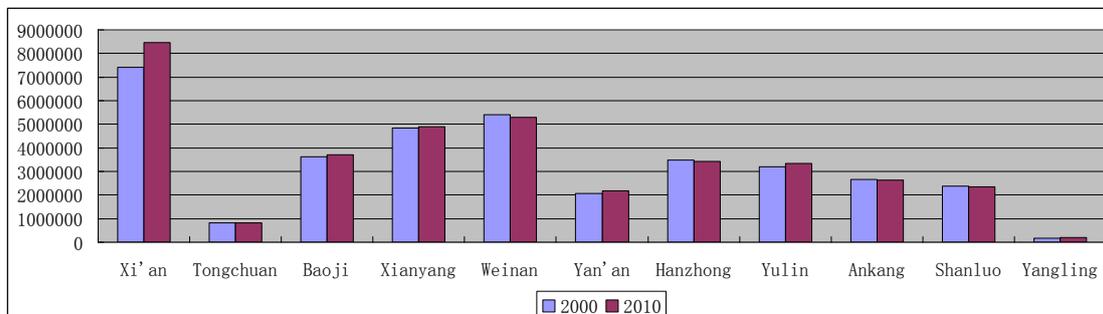


Figure 2. The residence population of the fifth and sixth census

4. Migration and urbanization model in Shaanxi

Demographic changes takes on different characterise in these three areas. General speaking, the central Shaanxi has been experiencing the increase of permanent residents. Especially, the mega city-Xi'an- which is located in central Shaanxi and is the dominant city of Shaanxi, has been experiencing a large number of permanent residents increase from every municipal regions throughout Shaanxi and other regions in Northeast China over the past several decades. For Northern and Southern Shaanxi, the population migration has complex characteristics. There are coexist that people with medium income and above that level who live and work in cities in these regions purchase house in megacity-city and become the temporary residents at this time, while people who live and work in rural areas purchase house or rent flats in dominant cities in these regions and become the self-urbanization residents^[3]. Figure 3 shows the migration direction in Shaanxi province

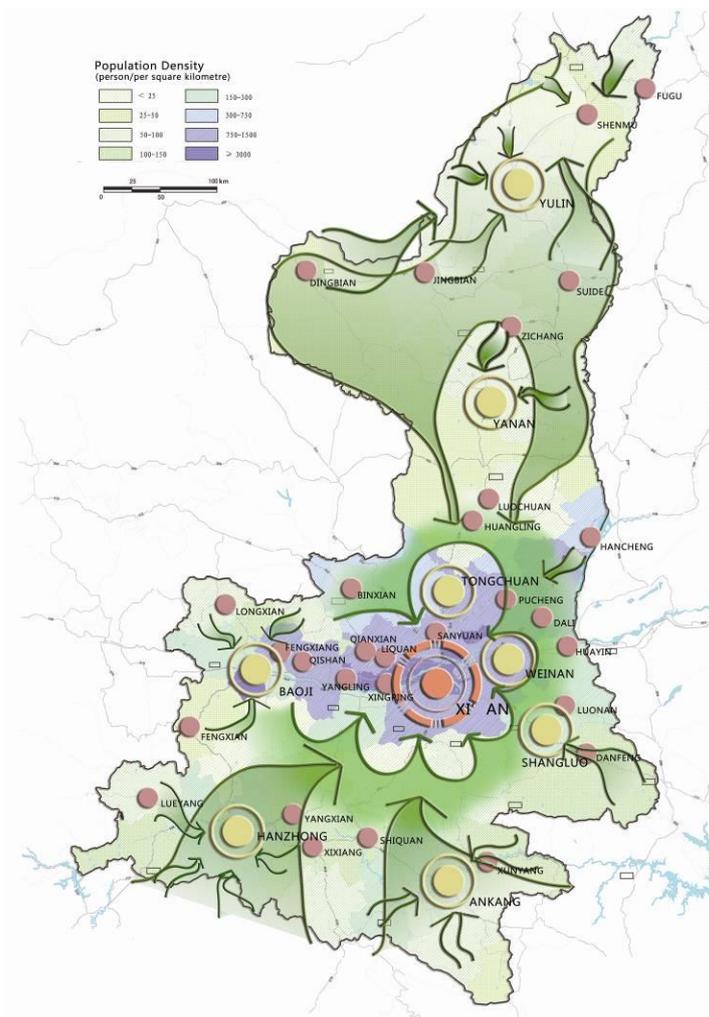


Figure 3. The migration of Shaanxi province

We take Yulin, Xi'an and Ankang as case study. The population migration of Yulin administration area is dominant city and industrial areas oriented. Town population of northern six counties is 1.63 times as that of southern six counties because of good natural condition and development potential. The intensity characteristics of population spatial distribution are consistent with the intensity of GDP spatial distribution. Yulin population migration is mainly composed of two parts, one of them is the middle-income class people migrate to the city of Xi 'an, and they purchase house in Xi 'an for children or themselves.

The other is a large number of agricultural surpluses labour transfer from rural areas to industrial areas or to other places where can provided employment opportunity or good living condition. In generally, their transfer destination mainly includes two types, one of which is to transfer to dominant city within the regions; the second is to transfer to various large industrial and mining within the administration area, such as Shenmu, Fugu, Jingbian and other places. According to the survey the ratio of agricultural surpluses labours that stay in this region to those moving outside the region is roughly 6:1. In terms of the spatial distribution, northern region is the main attraction place, accounted for about 80% of the total transfer surpluses labour. Especially the second industry's ability of the northern counties to attract and accommodate rural labour is better than six southern counties. Survey found that most of the surpluses labour who move to the regional dominant city would like to stay there forever, and urbanization has the characteristics of relatively long-term and stability; while the surpluses labour who move to the dominant towns in county would like to stay there temporary, and urbanization has the characteristics of seasonality and volatility. Figure 4 shows the migration direction of agriculture surpluses labour in Yulin.

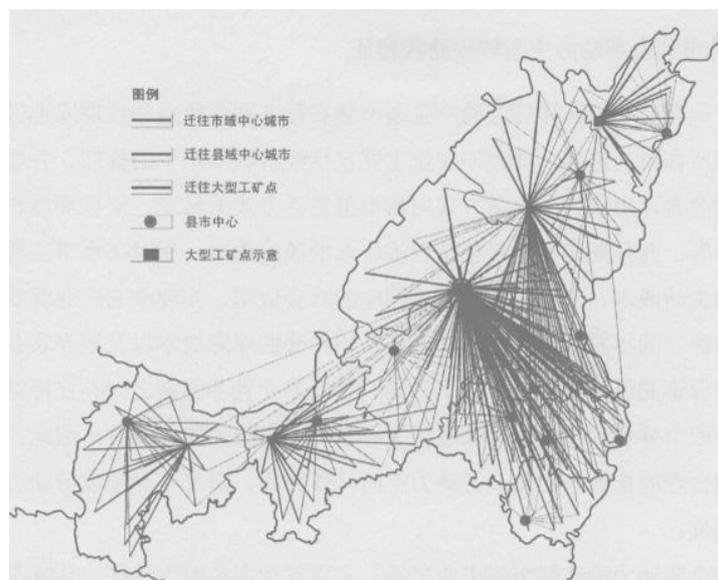


Figure 4 the migration direction of agriculture surpluses labour in Yulin

Sources: Hujia, *The dissertation of Xi'an University of Architecture and Technology*. 2010

For Ankang, that takes on different story. Some people with medium income or above that purchase house in megacity-city Xi'an and become the temporary residents. Agricultural surpluses labour transfers to dominant city within the regions or moving outside the region. Especially they move to Eastern China and stay there for a relatively long time and back at festival season. Figure 5 shows the change of residence population in Ankang in year 2000, 2005 and 2010. there are a little decrease of residence population that stay more than 6 months throughout the whole areas because of the difficult living and production condition in most of the mountain areas. The Ankang city proper became the main attraction place because of the better living condition and infrastructure within the administration area, but the attraction is limited at this moment compared with Megacity Xi'an and rapid development city Yulin.

Xi'an, as the dominant city of Shaanxi province and one of the mega-cities in China, has marvellous attraction for the people all over the province, even some people in Northwest China. The migration is characterized by coexist of permanent residence and long-term floating. From year 2000-2010, the net immigrant population as registering as permanent resident in Xi'an is 65.7900 totally while the resident population living longer than 6 months is 1.06 million. We can see that clearly from the Figure 6 and Table 3. Figure 6 shows the migration as registered permanent resident. The gap between the household registration population and permanent residents increase gradually. The number is much smaller

compared with the increase of resident population living longer than 6 months. That means there are big gap between the two statistics. Furthermore, it means that lots of population migration is Non-household registration population migration, but they stay much longer than 6 months as long-term floating. The bigger the city, the prominent the phenomena.

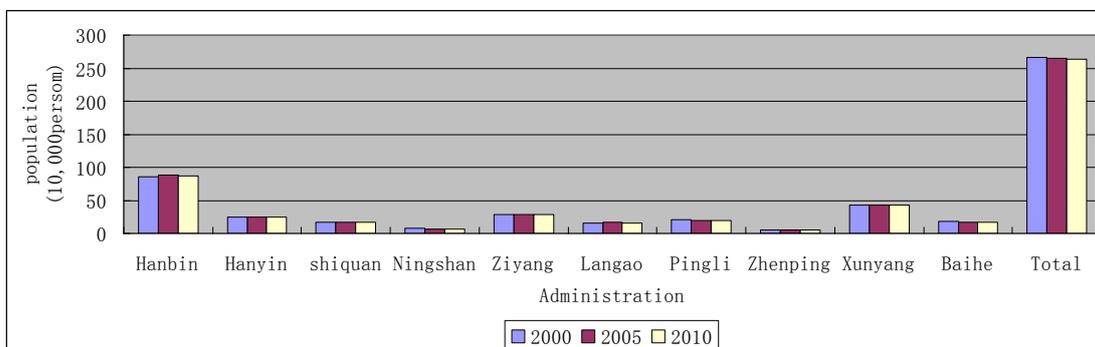


Figure 5 the change of residence population in Ankang in year 2000, 2005 and 2010.

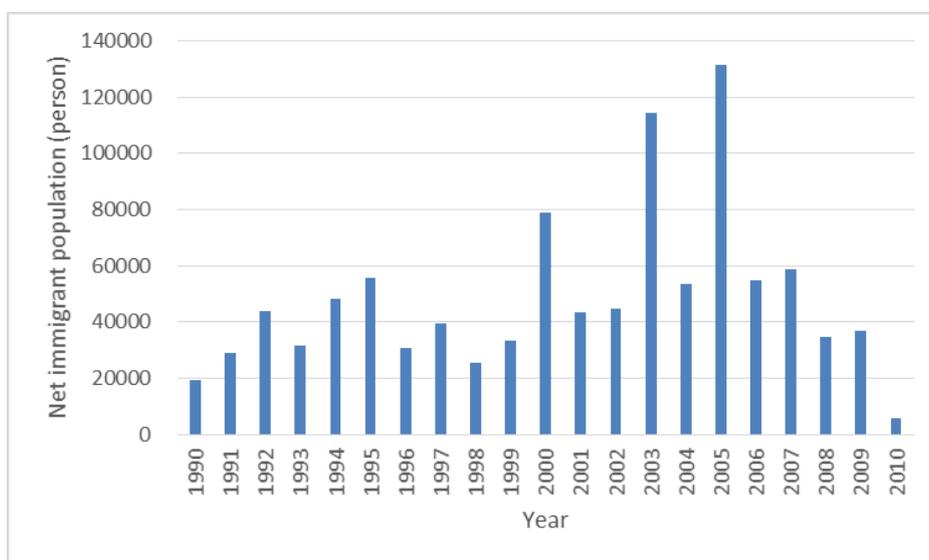


Figure 6 the migration as registered permanent resident in Xi'an

Table 3 the resident population and the Increase number

Year	residence population (10,000 person)	Increase number 10,000 person /per year
2000	741.14	
2005	806.81	67.67(5 years together)
2006	822.52	15.71
2007	830.54	8.02
2008	837.52	6.98
2009	843.46	5.95
2010	847.41	3.95
2011	851.34	3.93

Sources: Yearbook of Xi'an statistic.

According to the analysis above, we can conclude that migration in these regions means something more than that move from one place to another with registration as resident population, and it also means staying in other places without registration as resident population. The diverse migration models result in several migration flows and different urbanization model in different regions, for example, seasonal agriculture surplus labour and vocational and weekend migration population with medium income and stable job in other cities. All of this accelerates the complexity and make the population difficult to forecast. The Table 4 lists the migration characters in these three regions. Radial migration pattern is evident throughout the province, especially in rural areas. Both convergence and radial migration pattern have developed which made the Xi'an a powerful convergence centre. The industrial areas in Northern Shaanxi are as new attractive areas.

Table 4 The migration characters in these three regions

Regions	Migration Characters	Migration Impulses	The migration destination
Northern Shaanxi	Strong floating character: Some people purchase house in megacity-Xi'an and become the temporary residents. Agricultural surpluses labour transfer to dominant city within the regions or to various large industrial and mining within the administration area,	Employment opportunity, Education level, Living condition	Xi'an, Dominant city and towns, Industries areas
Guangzhong Plain	Coexist of permanent resident and long-term floating	Higher income, Better living condition	Xi'an or Towns immediate village with employment opportunity
Southern Shaanxi	Some people purchase house in megacity-city and become the temporary residents. Agricultural surpluses labour transfers to dominant city within the regions or moving outside the region.	Employment opportunity, Education level, Living condition	Xi'an, developed areas in costal areas.

5. Spatial evolution of the built-up areas of the dominant cities in three regions

Like most of the China's cities, the dominant cities in Shaanxi experience expansion continuously. Figure 7 shows the change of built-up areas of Xi'an, Yulin and Ankang. Xi'an grow fastest, and then the Yulin and Ankang grow is slower and stable.

The expansion of built-up area of Xi'an is radical. The main expansion direction is Southwest and North before 2002, and there is expansion in every direction since the beginning of 21st century.

In Yulin, from 2000 to 2007, the expansion in SS and S and SSW direction reach $292.08 \text{ hm}^2 / \text{year}$, $1004.49 \text{ hm}^2 / \text{year}$ and $276.05 \text{ hm}^2 / \text{year}$ respectively. And the expansion amount in this three direction account for 73.75% of total expansion amount. The extension in S direction accounts for 47.13%. The direction in east and north is at a lower level whether the expansion proportion of total land, or the amount of expansion. From 2007 to 2012, the expansion in SSE, S, and SSW direction is still larger. And the sum exceeds 50% of the total extension. What's more, the expansion rate is increasing each year. The expansion amounts

in NNE、NWW、NW and SEE direction increase by 3.8, 13.2, 14.3 and 16.7 times separately between 2007-2012 compared with those between 2000-2007. It shows that the South direction is still the main expansion direction while the North and West expand evidently.

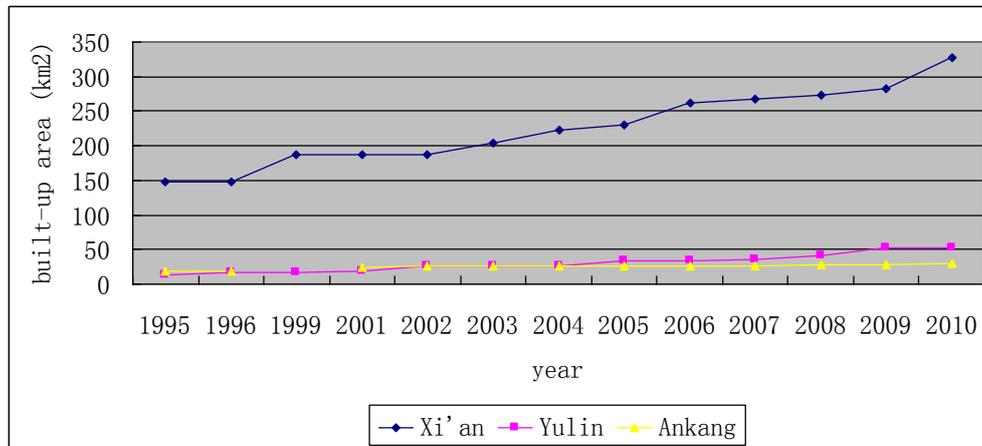


Figure7 the built-up areas of Xi'an, Yulin and Ankang

Sources: The yearbook of China's cities statistics.

For AnKang city, the spatial expansion in Northwest direction keep the leading position from 1985 to 2011. From 1985 to 2000, the increase amounts in Northwest direction reached 1.48 square kilometers. The increase amounts in Northern direction reached 0.82 square kilometer. The northeast direction growth was smallest, it was nearly 0. From 2000 to 2007, the expansion in Northwest direction was largest and the increase amount reached 2.55 square kilometers. The expansion in east direction accelerated and increased by 1.38 square kilometers. The expansion in North direction slow-down compared with the previous period. The northeast direction grows slowly because of the topography limit. From 2007 to 2011, the fast growth direction is still Northwest which increased by 1.22 square kilometers. However, the rate of expansion drops nearly 1/2 compared with the previous period. In this time, West direction has rapid development, which increased by 0.47 square kilometers.

6. The implement efficiency of plans in dominant cities

6.1 The implementation efficiency of population plans in Yulin, Xi'an and Ankang

The latest revision for comprehensive plan for these three cities was around 2008. Mega-city Xi'an has been experiencing the rapid population increase since the late of 20 century because it is the powerful convergence centre. Yulin and Ankang, as the dominant cities in Northern Shaanxi and Southern Shaanxi, the population is inconsistent with the planning prediction because different social and economic development condition and different population migration model. In Year 2000, there are less than 200,000 people in Yulin Built-up area. It is forecast in comprehensive plan the population in built-up area will be 250,000 in 2010, and 420,000 in 2020. But in 2007 the plan was revised because the population in 2006 is 350,000. The population tends to be underestimates in Yulin. Ankang, the increase of population and built-up areas is slower compared with Yulin. Table 5 shows the population forecast and practical increase in Ankang. And it demonstrates that population increase keep within the expectation. Sometime, the population tends to have been overestimates in Ankang. The reasons are that the impulses for Ankang are as not stronger as Yulin. Employment opportunity shortage results in people moving outside the region.

Table 5 The population forecast and practical increase in Ankang

1979's plan			1987's plan			2002's plan		
57000 People In 1979	Forecast the population will be 130,000 in 1985	Forecast the population will be 150,000 in 2000	140,000 People in 1987	Forecast the population will be 150,000 in 1990	Forecast the population will be 300,000 in 2000	244,000 People in 2000	Forecast the population will be 300,000 in 2005	Forecast the population will be 500,000 in 2020
The population within the same area in 2008 is 148981			The population within the same area in 2008 is 289451			The population within the same area in 2008 is 321144		

6.2 The implementation efficiency of land use plans in Yulin, Xi'an and Ankang

Different migration models make different urbanization models as well as different growth and spatial evolution characters of built-up areas of dominant cities. Furthermore, they result in different effectiveness of planning practices, especially, spatial development and layout because of the uncertainty in population.

Beside the population increase, the expansion directions are also difficult to forecast, especially, for the rapid development city. Figure 8 shows the planning boundary and the practical growth boundary in Yulin, Ankang and Xi'an. As we see from figure 8, the dominant cities in these three regions have different spatial expansion because of different social and economic development condition and different population migration model. The development and expansion of Yulin and Xi'an take on in consistence with comprehensive plan. The area of built-up area exceeds plan's expectations. Their driver forces are rapid economic growth and the construction of new development zone and services bases.

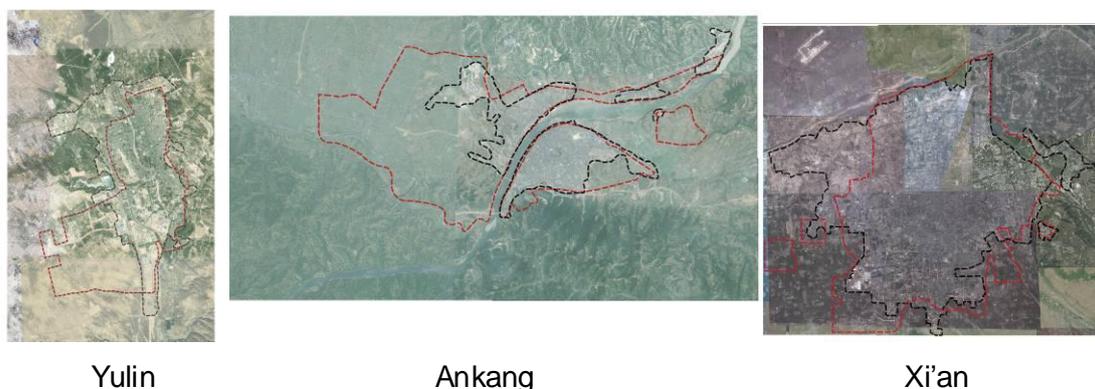


Figure 8 The planning boundary and the practical growth boundary

Note: Red line represents the plan boundary and the black line represents the practical boundary in 2012.

6.3 The relationship between migration models and spatial evolution of built-up areas

There are stronger relationship between migration models and spatial evolution of built-up areas. Different migration model results in different population convergence in region. The migration models are affected by several interconnected forces. One is the rapid economic development and the others are better employment and education opportunity etc.. What's more, the rapid population increases, especially the population without registration as resident population has played an important role for spatial evolution of built-up areas. The gap between the household registration population and permanent residents results in different effectiveness of planning practices, especially, to spatial development and layout because of the uncertainty in population. And it makes the plan prediction more difficult.

Figure 9 shows the GDP Growth rate in these three cities, and if we analyze it together with the spatial evolution of different cities, we could find that economy is the main driver force for these three cities. But the strength of driver force on spatial evolution has big difference, for example, the effect on Yulin is much strength than Ankang. Economy development is important force to shape the city's expansion. One the one hand, economic development provides more employment opportunity and spatial demand. Furthermore it results in population migration. One the other hand the construction of industry areas needs land in itself.

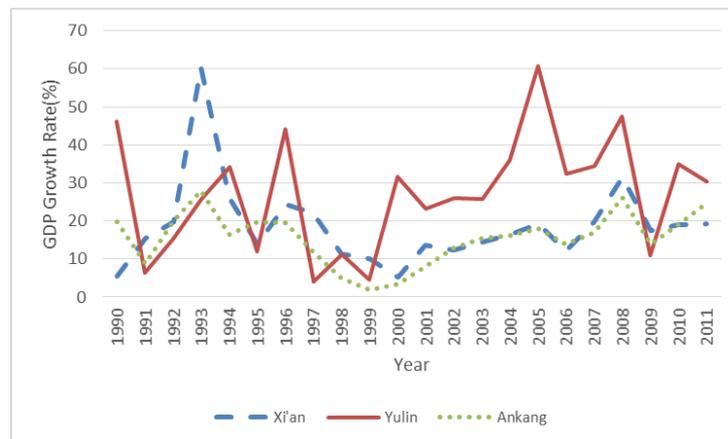


Figure 9 the GDP Growth rate in Yulin, Xi'an and Ankang

7. Conclusion

From the analysis above, we can draw the following conclusion.

[1] The features of dense populated in central Shaanxi and sparse in the North and South Shaanxi become more striking.

[2] The number of migration population is large in Shaanxi, and the trend that the population from rural to urban area, and from less developed areas to economically invigorating regions and big cities is more prominent.

[3] The central Shaanxi has been experiencing the increase of permanent residents. Especially, the mega city-Xi'an- has been experiencing a large number of permanent residents increase from every municipal regions throughout Shaanxi and other regions in Northeast China over the past several decades. For Northern and Southern Shaanxi, the population migration has complex characteristics.

[4] Migration in these regions means something more than that move from one place to another with registration as resident population, and it also means staying in other places without registration as resident population. The diverse migration models result in several migration flows and different urbanization model in different regions,

[5] The gap between the household registration population and permanent residents results in different effectiveness of planning practices, especially, to spatial development and layout because of the uncertainty in population. And it makes the plan prediction more difficult.

[6] Different migrations models call for new ways of thinking and new models of planning practice

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