Effects of Urban Services on Migration among Cites in Guizhou in China

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1. Background and Purpose

Guizhou province, located in the central part of southwest China, is a typical inland remote province. Due to its natural geographical environment, history and other reasons, the development of Guizhou province has been relatively slow for a long time. The purpose of this study is to estimate the quality of life in each city in Guizhou province through migration among cities in Guizhou province using infrastructure and other quantity of life service levels, from 2011 to 2018, to find out the factors of population migration in every city and county of Guizhou province, especially to use Roback model to clarify the conditions affecting population migration in Guizhou province, and to calculate the value of amenity.

2. Overview of the study area

This study covers all 9 cities in Guizhou province; Figure 1 shows the city map of Guizhou, and Table 1 shows the population by city. Figure 1 shows the locations of the 9 cities. The main areas of Guizhou Province in terms of population (Table 1), consists of Guiyang City, Zunyi City, Anshun City, Liupanshui City, and Bijie City, has a population density of more than 200 people / km^2, especially the capital of Guiyang City, which has reached 598 people / km^2.

Figure 1. Population density of Guizhou Province

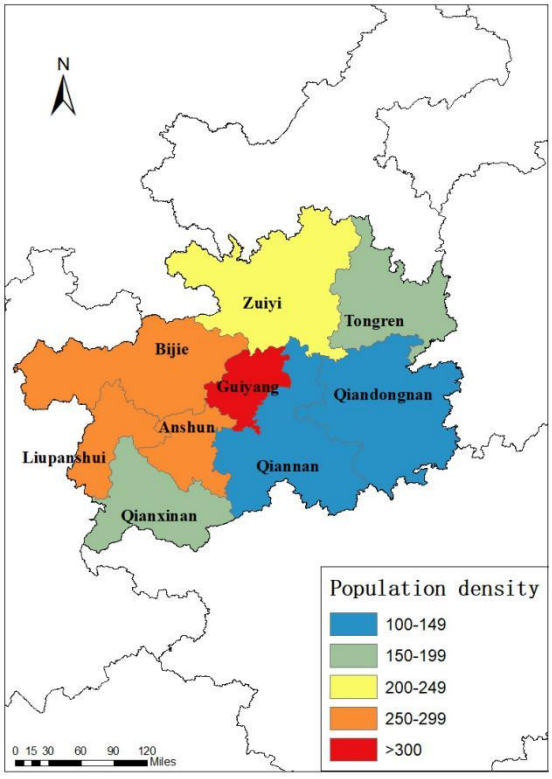

Table 1. Urban population of Guizhou Province[1),2)]

City	Population (10,000 persons)
Guiyang	480.20
Zunyi	627.07
Anshun	235.37
Liupanshui	293.73
Bijie	668.61
Tongren	316.88
Qiannan	329.21
Qiandongnan	353.83
Qianxinan	287.17

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3. Amenity model

This study is based on Rosen-Roback's general equilibrium model[3),4)]. The research area is Guizhou Province, China, and the residential unit is the city.

Using the living environment data of the region, the model of amenity evaluation is specified as follows.

$$\frac{\Delta N_t^i}{N_{t-1}^i} = \sum_{l=1}^{L} A_{l,t} S_{l,t}^i + B \quad (1)$$

(i: city, t: time, N: population, ΔN: population change, l: type of amenity, L: total number of amenity, S_l: quantity of amenity l, A_l, B: parameters)

The ultimate value of amenity is derived by using the obtained coefficient. This represents the evaluation amount of each amenity level when the living environment changes by 1% on average.

$$P_{l,t}^* = \frac{\partial u / \partial S_{l,t}}{\partial u / \partial S_{k,t}^*} = \frac{A_{l,t}}{A_{k,t}} \quad (2)$$

Where u is the utility function reflecting the utility that a resident can obtain given amenities.

(P_l^*: value (price) of amenity l, S_k^*: income)

In addition, the total amenity value of each city is calculated as follows.

$$QoL_t^i = \sum_l P_{l,t}^* S_{l,t}^i \quad (3)$$

Where QoL is the sum of the amenities in the given city.

4. Data and Results

4.1 Summary of data

This paper uses the panel data of 9 cities in Guizhou Province from 2011 to 2018, the data comes from the statistical yearbook of Guizhou Province, China.

The dependent variable is defined as the rate of change of urban population after the removal of natural growth rate

$$Y^i{}_t = \frac{population^i{}_t - population^i{}_{t-1}}{population^i{}_{t-1}} - NaturalGrowth^i{}_{t-1} \quad (4)$$

Taking 9 cities in Guizhou Province as the object, 50 kinds of amenity variables are used. Such as population composition (ex. Sex ratio, Elderly population ratio, Youth population ratio), Cultural entertainment (ex. libraries), infrastructure (ex. roads, water supply, and sewage pipes), employment (ex. second industry employment rate), finance (ex. expenditure and revenue), Health care (ex. hospitals, utilization rate of beds, and doctors per thousand person), education (ex. kindergartens, schools, and teachers), Security and safety (ex. traffic accident, and production safety accident), and so on .

For the regression model, the random effects model is employed and the fixed effect (specific for each city) is ignored.

4.2 Results

For this analysis, multivariate regression analysis was performed using statistical analysis software R Language. Using stepwise regression analysis is to delete or add variables by selecting the smallest AIC information criterion based on the AIC information criterion.

The results were shown in Table 2. There are 6 significant independent variables.

Female employment rate ($x11$) is positive and has a significance of 0.1%. The reason is that in recent years, with the rapid development of tourism, it has driven the development of traditional handicraft industry (embroidery, batik, and other minority handicrafts) and provided a lot of employment opportunities, especially for female, so as to attract the female population into Guizhou Province.

Per 1000 capita total annual volume of water supply ($x40$) is also positive and significant with 0.1%. It represents the trend of urbanization, and high-quality urban infrastructure providing convenient living environment for residents.

Per 1000 capita of fire accident ($x34$) is a negative correlation and significant of 5%, which shows that the residents are concerned about the safety of living environment, especially the fire accidents which cause loss to life and great property.

Annual average income ($x45$) with 10% significance has always played a positive role in attracting people. However, Guizhou Province is a backward area in China, the level of income is low, so it is not very significant to affect the population.

Per 1000 capita of beds of hospitals ($x50$) represents the result of the improvement of the medical service level and is considered to be the demand of the residents for a healthy environment, so it is also positive with significance of 10%.

Elderly population ratio ($x2$) is negative insignificant, which shows that people's negative attitude towards aging cities has some affects in terms of AIC criterion.

Table 2. The results of Social population change rate

variables	Name of indicator	Estimate	Std. Error	t value	
x2	Elderly population ratio	-1.354	0.819	-1.65	
x11	Female employment rate	5.494	1.380	3.98	***
x34	Per 1000 capita of fire accident	-4.603	1.443	-3.19	**
x40	Per 1000 capita total annual volume of water supply	1.612	0.249	6.47	***
x45	Annual average income	1.001	0.562	1.78	.
x50	Per 1000 capita of beds of hospitals	0.592	0.349	1.70	.
Adjusted R-squared: 0.689				***: 0.1%	**: 1% .: 10%

4.3 Amenity Value

Using the equation (3) in Section 2, the total amenity values of 9 cities in Guizhou Province are calculated. The denominator in formula (2) is "Annual average income ($x45$)" is the basis of value calculation, and therefore the union representing the total amenity value is "Yuan".

Table 3 shows the resulting values of QoL. It can be seen that as the capital city of Guizhou Province, the total value of quality of life of Guiyang is undoubtedly the first. No matter the infrastructure, medical conditions or income are ranked first among the cities in the province, and the frequent occurrence of accidents in such a high-density population city as Guiyang is inevitable. As the second-largest city in Guizhou Province, Zunyi City has high scores in infrastructure construction and medical treatment. In addition, it can be found that the most significant female employment rate values are Qiannan, Qiandongnan, and Qianxinan. The reason is that these three areas are ethnic minority areas with rich cultural tourism resources. With the rapid development of the tourism industry in recent years, the demand for traditional handicrafts is also increasing, which greatly improves the female employment rate.

Table 3. Total value of amenity of social population change rate

Cites	Annual average income	Female employment rate	Per 1000 capita total annual volume of water supply	Per 1000 capita of fire house accident	Per 1000 capita of beds of hospitals	Elderly population ratio	QoL
Guiyang	35150.12	225.91	13.15	-1.67	4.12	-20.61	35371.02
Zunyi	32312.45	235.35	2.62	-0.36	4.63	-23.6	32531.09
Anshun	29703.67	224.92	2.89	-0.79	3.40	-24.21	29909.88
Liupanshui	30405.38	223.77	2.02	-1.23	3.91	-22.25	30611.6
Bijie	29917.89	235.51	0.84	-0.24	2.08	-20.64	30135.44
Tongren	29451.42	223.44	1.95	-1.07	3.68	-21.43	29657.99
Qiannan	31167.14	244.90	1.39	-0.82	4.05	-20.72	31151.04
Qiandongnan	30160.13	243.03	1.58	-0.77	4.59	-20.15	30388.41
Qianxinan	30437.41	246.60	1.75	-1.37	3.59	-16.77	30424.61

5. Conclusion

In this study, based on Rosen-Roback modeling, the model to explain the relationship between social population change rate and amenity for Guizhou Province is constructed and estimated by multiple regression analysis. The amenity variables with significant impact on intra-provincial migration and therefore amenities of local residents are expounded. The importance of social population change lies in the "total annual volume of water supply", which is considered as an indicator of the development of urbanization trends, which also indicates that there are many employment opportunities. The occurrence of fire accidents and the number of beds in hospitals also have a certain impact on the change of social population, which proves that residents pay more and more attention to safety and hope to live in a healthy and safe environment. In addition, according to the characteristics of the local industrial structure in Guizhou, the result that the female employment rate has a significant impact on the social population is also an innovation in this study. With the development of the tertiary industry, Guizhou Province also provides more employment opportunities. This research model can calculate the total value of amenity, so it can also evaluate and rank the area according to the total value of amenity. Therefore, Guiyang city has the highest total value of amenity, while the lowest is Tongren city.

This paper also has some limitations. First of all, as Guizhou Province is a backward region in China, many data are missing. Secondly, the selection of infrastructure in the empirical analysis only reflects the level of urban infrastructure but not quality. Therefore, in the next step of the research, using the updated micro database to build a more reasonable index to quantitatively analyze the level of urban infrastructure and its differences among different types of residents will be the focus of the author.

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