Trend of Urbanization Rate in China Various Regions

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Abstract. Urbanization is a key part of achieving a overall well-off society in it's decisive stage. Accurately predicting the developing trend of urbanization rate has important practical significance for relevant departments to make strategic decisions. This article uses Stata software and the relevant data released by Data Center of the National Bureau of Statistics, selects the urbanization rate time series data of 31 provinces of China from 1990 to 2019, establishes an ARIMA model of urbanization rate and time, and predicts 2020 to 2050. Trend of urbanization rate in various regions. The data shows that, excluding individual areas, the urbanization rate of each area can reach 72% in 2030 and over 90% in 2050. However, the development of urbanization rates among regions is uneven, and relevant departments should formulate a reasonable development strategy on the basis of sustainable and balanced development.

Since the reform and opening up, China’s urbanization has shown rapid and large-scale development. At the end of 2019, China's urbanization rate exceeded 60%, and it was in the rapid development range of urbanization rate[1]. In 2020, a series of measures will be launched to ensure the smooth progress of a new type of urbanization with Chinese characteristics. Such as speeding up the reform of the household registration system and lowering the restrictions on settlement. However, the urbanization process itself has both opportunities and risks: on the one hand, urbanization promotes economic growth, stimulates domestic demand, absorbs rural surplus labor, optimizes regional industrial structure, promotes technological progress and cultural exchanges between regions; On the other hand, urbanization has caused a large number of young laborers to flow to cities and towns, the phenomenon of "empty-nest elderly" is prominent, and the problem of elderly care in rural areas has been exacerbated; The loss of rural labor forces has left high-quality arable land uncultivated, and the problem of arable land becoming wasteland has become more and more serious; In addition, the food structure of urban and rural residents differs greatly. As the level of urbanization increases, the contradiction between food supply and demand appears, posing a challenge to food safety. Therefore,
accurately predict the development trend of urbanization in various provinces and cities in our country, and provide assistance to relevant departments in making strategic decisions.

This article will include the following aspects, literature research, data explanation and description, ARIMA model introduction, model estimation and prediction, conclusions and discussions.

1. Introduction

Some scholars have conducted research on the causes of population urbanization. Guo Dongjie and Wang Xiao Qing (2013) reveal the phenomenon of population flow from rural areas to urban areas based on the perspective of urban-rural income differences. Population mobility is greatly affected by regional economic development and openness. The income of the urban sector is higher than that of the agricultural sector. The migration of rural to urban areas will continue to occur, and rural labor will continue to flow into cities and towns [2].

Some scholars have also studied the age composition of the population flowing to cities and towns. For example, Chun He (1988) believes that the inflow of urban migrants is mainly the influx of young labor, and workers and farmers account for the majority of the migrants [3]. Lin Bao (2018) thinks that the immigrant population is mainly the movement of young people to urban areas, and the urbanization of the elderly population lags behind the urbanization of the total population [4].

Some scholars have also conducted research on the impact of population urbanization. Chen Fenggui et al. (2010) informs that population urbanization is a process of population concentration in cities and towns, and people’s production methods have also changed from agriculture to secondary and tertiary industries. At the same time, population urbanization will promote land urbanization and bring about changes in the nature of land. This will bring about changes in the way and degree of land use[5]. Wei Houkai (2015) says that the rapid growth of China's urbanization economy in recent years has been supported by the "flat expansion" of land, which has caused the occupation of a large amount of arable land, even more high-quality arable land, and the decline in the quantity and quality of arable land[6]. A problem that cannot be ignored is that farmers who lose their land may be "urbanized" forever.

The urbanization rate is one of the indicators to measure the development level of a country or region. Although China's urbanization rate has developed rapidly, from 26% in 1990 to 60% in 2019, it still has not reached the average level of urbanization in developed countries in the same period. The urbanization rate in developed countries is usually above 75%. According to the statistics of the US Central Intelligence Agency's "World Facts" in 2020: the urbanization rate of the Netherlands is 92%, Japan's urbanization rate is 91%, the United States' urbanization rate is 82%, and South Korea's urbanization rate is 81%. The urbanization rates of developed countries such as the United States, Japan, and South Korea have all exceeded 75%. (http://www.360doc.com/content/20/0716/07/11642211_924525180.shtml)

The development of China's urbanization rate has aroused widespread concern. Many scholars have conducted quantitative research on urbanization trends. Guo Yinshan (2018) used the ARIMA model and the GM (1,1) model to curve-fit China's urbanization rates respectively, and found that the ARIMA model has a better fit. It also predicts that China's urbanization rate will be 60.95% in 2020 [7].

Although these scholars have done a lot of work, they cannot reach consensus on their opinions and results on the prediction of urbanization level. For example, Gao Chunliang and Wei Houkai (2013) predict that the urbanization rate in the future will slow down and the growth rate will decrease after 2010. The urbanization rate by 2050 is 81.63% [8]. Qiao Wenyi (2018) used system dynamics model and combined with the development requirements of a new type of urbanization centered on people, and predicted that the urbanization rate will reach 76%-79% by 2050 [9]. Some scholars have not given a clear forecast value for the urbanization rate prediction. Liu Hongtao (2018) used the Logistic growth model to find the stage cut-off point and predicted that by 2050, China’s urbanization level will reach a moderately developed country. The growth rate will gradually decrease, and the acceleration of the urbanization rate will be negative and will continue to decrease [10].

Judging from the existing research results, some scholars mostly analyze the urbanization rate of a certain province, and rarely analyze the urbanization rate of each province in the country; from the
content point of view, many documents mostly predict the urbanization trend in 10-15 years, and there are few forecasts over 20 years. Based on this, this article selects the urbanization rate data of each province from 1990 to 2019 to perform ARIMA regression, predicts the urbanization level of each province from 2020 to 2050, and then grasps the change trend of the urbanization rate of each province and city. It is hoped that it can provide support for the comprehensive construction of a well-off society and the acceleration of rural revitalization.

2. Data and its Descriptive Analysis

2.1. Data selection

The time series data of the urbanization rate of 31 provinces (excluding Hong Kong, Macao and Taiwan) selected in this article from 1990 to 2019 are from the Data Center of the National Bureau of Statistics.

2.2. General description

It can be seen from Fig. 1 that China’s urbanization rate (the dark part of a histogram, which shows the change of urbanization rate from 1990 to 2019 in various region of China.) has changed in four trends: Firstly, the overall urbanization rate has risen across the board. With the exception of Tibet, the urbanization rate of other provinces across the country is basically on the rise. Secondly, the level of urbanization in the eastern and central regions is developing rapidly, and the overall urbanization rate is relatively high. Thirdly, the growth and changes in other regions are different. The urbanization rate of Northeast China is growing slowly, but the starting point of urbanization is relatively high; the urbanization rate of Northwest China is rising slowly; the development of Central South and Eastern is rapid; the southwest region except Sichuan, Yunnan, Guizhou and Tibet have low urbanization rates. From the perspective of several key cities, the urbanization rate of the three cities of Beijing, Tianjin, and Shanghai has been maintained at a high level since the beginning, which is higher than that of other provinces, and the level of urbanization has been on the rise, while Chongqing has started. Later, but it's development is relatively rapid.

![Figure 1: Schematic diagram of the development trend of urbanization rate in various regions of China.](image)

Note: In the histogram of each province in the map, dark black represents the urbanization rate from 1990 to 2019, and red represents the predicted urbanization rate from 2020 to 2050.
3. Quantitative Analysis

This study intends to build the ARIMA model based on time series data of urbanization rates in various regions from 1990 to 2019, and predict changes in the next 30 years. The ARIMA model is a classic model for studying time series. This model predicts the development of future data by analyzing time series data and looking for rules.

3.1. Model description

ARIMA (p, d, q) model introduction

The ARIMA model is the differential autoregressive movement model. After the ARIMA model transforms the non-stationary time series into a stationary series, an ARMA model is established on this basis, p is the autocorrelation order, d is the difference order, and q is the movement Average order.

The modeling process of the ARIMA (p, d, q) model is as follows:

ARMA(p,q) Model is the combination form of AR(p) Model and MA(q) Model, the formula is: \( y_t = \beta_0 + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + \theta_1 \varepsilon_{t-1} + \ldots + \theta_q \varepsilon_{t-q} + \varepsilon_t \).

This research fits 31 provincial time series model, as gets the moving average order q is zero, therefore, when \( q = 0 \), ARIMA(p,0,0), the formula is: \( y_t = \beta_0 + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + \varepsilon_t \) (1)

ARIMA(p,1,0), the formula is: \( y_t = \beta_0 + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + \varepsilon_t \) (2)

ARIMA(p,2,0), the formula is: \( y_t = \beta_0 + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + \varepsilon_t \) (3)

From the table 2, this research includes three kinds of model: ARIMA(1,1,0), ARIMA(1,2,0), ARIMA(2,2,0), therefore, the model formula could transfer to:

ARIMA(1,1,0), Substitute \( \Delta y_t = y_t - y_{t-1} \) into formula (2),

It transfers to: \( y_t = \beta_0 + (\beta_1 + 1) y_{t-1} - \beta_1 y_{t-2} + \varepsilon_t \) (4)

ARIMA(1,2,0), Substitute \( \Delta y_t = y_t - y_{t-1} \) into formula (3),

Its formula transfers to: \( y_t = \beta_0 + (\beta_1 + 2) y_{t-1} - (2\beta_1 + 1) y_{t-2} + \beta_1 y_{t-3} + \varepsilon_t \) (5)

ARIMA(2,2,0), Substitute \( \Delta^2 y_t = \Delta y_t - \Delta y_{t-1} \) formula (3),

It is: \( y_t = \beta_0 + (\beta_1 + 2) y_{t-1} - (2\beta_1 + 1 - \beta_2) y_{t-2} + (\beta_1 - 2\beta_2) y_{t-3} + \beta_2 y_{t-4} + \varepsilon_t \) (6)

Establishing an ARIMA model, it is necessary to ensure the stability of the time series. First, perform stationary test on the time series. You can judge whether it is a stationary series by observing the line chart of the time series, ADF unit root test and other methods. If the sample does not meet the stationary test, you can adjust the series by the difference method and convert it to Stationary series. Determining the autocorrelation order p and moving average order q in ARIMA, and estimate the specific model form. Observe the ACF diagram and the PACF diagram, and use the truncation of the sample's autocorrelation function (ACF) and partial autocorrelation function (PACF) to determine the order (Table 1). Then the order is determined by the combination of AIC criterion and BIC criterion.

When q = 0, ARMA (p,q) is simplified to AR(p) model; when P = 0, ARMA(p,q) is simplified to MA(q) model.

Testing the fitted model. To test whether explanatory variables are omitted from the fitted model, a white noise test is required. Check whether the residual sequence is a white noise sequence. If the test is a white noise sequence, it proves that there is no relevant information in the residual and the modeling is completed; if it is not a white noise sequence, as should be considered increasing the lag order of the model before proceeding, and then has a white noise check. The main specific models list in the Appendix of the research back.

Table 1: ARIMA (p,q) order determination method

| model   | ACF                | PACF                |
|---------|--------------------|--------------------|
| AR(p)   | attenuation approaches zero | p-order post-censor |
| MA(q)   | q-order after censoring | attenuation approaches zero |
| ARMA(p,q) | Attenuation tends to zero after q-order | Attenuation tends to zero after p-order |
3.2.1. ADF stationary test

Observing the discount map of time series data in various regions (omitted), it is found that the annual data of urbanization rate has a clear time trend. Therefore, the time series data of urbanization rate is processed by differential change. After differential processing of the time series data using stata software, the ADF test was performed, and the results showed: The sequence rejects the null hypothesis at least at the 5% significance level, so the original data is stable after the difference processing, and the ARIMA model can be constructed (column 2-5 in Table 2).

3.2.2. Order determination and coefficient estimation

After the data is differentially processed, the order of the ARIMA model is determined. Using autocorrelation function graph and partial autocorrelation graph, combined with AIC criterion and BIC criterion, model fitting is performed on time series samples and the model coefficients are determined.(column 6-15 in Table 2).

3.3. Forecast results

The prediction results obtained by the model formula can be seen (column 16-19 in Table 2).

North China: The urbanization rate of Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia will all exceed 70% in 2030. In 2050, the urbanization rate of Hebei and Shanxi will reach 100%, Tianjin will
exceed 90%, Inner Mongolia will reach 83%, and Beijing's urbanization rate has remained around 86% since 2010, with very small fluctuations.

Northeast China: Heilongjiang, Liaoning, and Jilin had very high urbanization rates in 1990, ranking 4th, 5th, and 6th in the country. However, the process of urbanization rate has been slow since then, all of which will be around 68% in 2030, and 77%, 73%, and 85% in 2050, which are lower than the national average level of urbanization rates.

Eastern China: By 2030, with the exception of Shandong's urbanization rate of 68%, the urbanization rates of Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, and Jiangxi will all exceed 70%. By 2050, in addition to the 77% urbanization rate in Shandong, the urbanization rate in Jiangsu, Anhui, and Fujian will reach 95% or more. The urbanization rate of Shanghai will reach 100% in 2021. The urbanization rate of Zhejiang and Jiangxi can reach 100% around 2045.

Central and South China: In 2030, Guangdong's urbanization development speed reached 80%, Henan, Hubei, and Hunan also reached 70%. The urbanization rate of Guangxi and Hainan was lower than the national average.

Southwest China: Chongqing is developing rapidly with an urbanization rate of 82% by 2030, and an urbanization rate of 100% by 2045.

Northwest China: By 2030, Ningxia will reach 70%, and Shaanxi and Qinghai will reach 74%.

All-China: It can be seen from the results that China's urbanization rate is increasing year by year and will reach 72% in 2030.

4. Conclusion and Discussion

It should be noted that Jiang Xiaolan et al. (2013) mentioned that it is difficult to predict the population urbanization rate of a country or region over a long period of time. The change of the urbanization rate depends on various factors of the country’s social development in the future. These factors are uncertain [11]. The trend forecast of the urbanization rate in this paper is only based on the selected time series samples and analyzed according to the inherent laws of the time series data. For certain factors that affect the urbanization rate, such as policy trends, natural disasters, etc., this is Unpredictable.

Based on the relevant data released by the National Bureau of Statistics from 1990 to 2019, this article analyzes the trend of urbanization rate and time, predicts the level of urbanization rate from 2020 to 2050, and draws the following conclusions: Firstly, the urbanization rate of all regions is increasing year by year, but Beijing's urbanization rate will always remain at around 86%. Secondly, with the exception of individual regions, the urbanization rate in most regions can reach 70% by 2030; by 2050, the urbanization rate in most regions can exceed 80%, reaching the level of urbanization rates in developed countries. By 2050, the urbanization rate in most regions can exceed 80%, reaching the level of urbanization rates in developed countries. Thirdly, from a national perspective, the urbanization rate in the eastern and southern regions is developing rapidly and the urbanization level is high; the urbanization level in the west is relatively backward.

By 2030, the urbanization rate of Jilin, Heilongjiang, Shandong, Guangxi, Hainan, Guizhou, Yunnan, Tibet, Qinghai, and Xinjiang will be lower than the national average. According to the development characteristics of various regions, the state should tap advantageous resources, optimize the industrial structure, increase policy support for areas with urbanization rates lagging, and create favorable conditions for the development of urbanization.

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