# Research on the relationship between urbanization, industrial structure and urban-rural income gap-Taking Sichuan province as an example

*Bing* Li*, and *Yinfeng* Liu

School of Public Affairs and Administration, University of Electronic Science and Technology of China

**Abstract.** This paper selects three indicators of urbanization, industrial structure and urban-rural income gap to construct a three-dimensional VAR model. Through Granger causality test, impulse response function and variance decomposition methods, a dynamic analysis of urbanization and industrial structure on urban-rural income gap in Sichuan Province has been carried out. The research shows that: urbanization and industrial structure have an important impact on the urban-rural income gap in Sichuan Province. Urbanization and the urban-rural income gap present a "U-shaped" relationship, that is, in the initial stage when the level of urbanization increases, the urban-rural income gap will be narrowed, and when urbanization develops to a certain degree, the gap will gradually be widened. The relationship between the industrial structure and the urban-rural income gap is an "inverted U-shaped" relationship, that is, the urban-rural income gap will be widened when the industrial structure is at a lower level. As the industrial structure is optimized and upgraded, the gap will gradually be narrowed.

**Keywords:** Urbanization, Industrial structure, Urban-rural income gap, VAR model.

## 1 Introduction

Expanding the proportion of middle-income groups and realizing common prosperity for all people is an important part of the Chinese government's goal of building a moderately prosperous society in all respects, completing the 14th Five-Year Strategic Plan, and realizing the long-term goal of socialist modernization.

It is a great concern of the Chinese government as how to narrow the income gap between urban and rural areas. Since the reform and opening up, the level of urbanization in China has increased rapidly, and the gathering of urban population has been accelerated. At the same time, with the increase of economic growth and labor productivity, China's

* Corresponding author: 1065810507@qq.com

industrial structure has also been continuously optimized and upgraded. In 1999, the total output value of the secondary and tertiary industries accounted for 83.9%, and by the end of 2020, it has accounted for 92.9%, and the industrial structure has been significantly upgraded. Driven by urbanization and industrial upgrading, the per capita income of urban and rural residents in China has increased significantly, but the income gap between urban and rural areas is also gradually widening. On the whole, the urban-rural income ratio in 1999 was 1.996, which is a small gap, and In 2009, it reached the highest value of 2.65. Although it has shown a gradual decline since then, it is still higher than other developed countries. Therefore, grasping the opportunities and challenges brought about by urbanization and industrial structure optimization and upgrading is a must way to narrow the urban-rural income gap and achieve common prosperity.

Scholars in China have conducted in-depth discussions on the relationship between urbanization, industrial structure upgrading and the urban-rural income gap and formed a mature theoretical system. However, the research on the income gap between urban and rural areas is mostly concentrated on a single level, and most of the domestic research objects are on a national scale, and there are few special studies on Sichuan. Therefore, this paper will analyze the relationship between urbanization, industrial structure and urban-rural income ratio in Sichuan Province by building a VAR model, to provide suggestions for narrowing the urban-rural income gap.

## 2 Empirical analysis based on Sichuan

### 2.1 Variable selection and data sources

Urbanization (URB) refers to the continuous transfer of rural population to non-agricultural industries and urban areas, the continuous gathering of secondary and tertiary industries to urban areas, and the non-agricultural deployment associated with employment and industrial structure. This is a natural, economic and social historical process of continuous expansion of urban population and geographic area. Since the essence of urbanization is still the gathering of population in cities and towns, which is commonly referred to as population urbanization, and considering the consistency of national statistical standards and the availability of historical data, this paper selects the most used urbanization rate, which is the proportion of urban permanent residents to the total population, to measure the level of urbanization.

Industrial structure (TS) refers to the changes in the composition of the industrial sectors of the national economy and within each industrial sector and is generally measured by the proportion of the three industries. This paper uses the output value of the secondary and tertiary industries as a percentage of the total output value to indicate the degree of optimization of the industrial structure.

There are many indicators for measuring the urban-rural income gap (IG). This paper uses the urban-rural income ratio (the ratio of urban per capita disposable income to rural per capita net income), which is also commonly used by Chinese scholars.

On the basis of not changing the dynamic relationship between the variables, in order to eliminate the possible heteroscedasticity influence in the time series, the three variables are all processed by logarithm to get lnURB, lnIG, and lnTL.

All the data in this paper comes from the "Statistical Yearbook of Sichuan Province", the time span is 1999-2020. Data of urbanization, industrial advancement, and urban-rural income gap are obtained through the analysis. The data analysis and processing software is Eviews 6.0 version.

### 2.2 Model setting

In this paper, a vector autoregressive (VAR) model is used to determine the dynamic impact of random disturbances on the variable system. The mathematical expression of the model is:

$$y_t = \alpha + \sum_{i=1}^{p} \beta_i y_{t-1} + \sum_{j=1}^{r} \gamma_j x_{t-j} + u \quad (1)$$

Among them: yt is the endogenous variable, yt-1 is the lagging endogenous variable, p is the lagging order; xt-j is the lagging exogenous variable, and r is the lagging order. α, βt-1,..., βt-p and γt-1, γt-2,..., γt-j are the determination criteria of application model lag structure, and period 2 is determined as the optimal lag period of the model. Therefore, we establish the stationarity test of the time series of the VAR model with a lag of 2 periods.

### 2.3 Unit root test

For time series data, unit root tests must be performed before empirical analysis to determine the stationarity of the data and to avoid the phenomenon of "false regression", which means that the established measurement model is meaningless.

Table 1. ADF unit root test results.

| Variable | Inspection form（C,T,L） | ADF | Critical value(5%) | Conclusion |
|---|---|---|---|---|
| IG | (0,0,2) | -1.519946 | -1.955681 | unstable |
| ΔIG | (C,T,0) | -3.921174 | -3.622033 | stable |
| TS | (C,0,2) | 0.000948 | -2.991878 | unstable |
| ΔTS | (0,0,0) | -4.555317 | -3.622033 | stable |
| URB | (0,0,2) | -1.521250 | -1.955681 | unstable |
| ΔURB | (C,T,2) | -4.891355 | -3.622033 | stable |

Note: ΔLnUR represents the first difference of LnUR, the same below; (C, T, L) represents that the test model contains intercept term, trend term and lag order; *, *, * * represent the critical value at the significance level of 10%, 5%, and 1% respectively

It can be seen from Table 1 that the original series of variable logarithms are all unstable, and their first-order difference series are all stable. Therefore, each variable logarithm series is a first-order single integer time series.

### 2.4 Granger causality test

Granger causality test can judge whether there is a causal relationship between variables. We test the three variables in the VAR model to construct a general test regression equation

$$\mathrm{Ln}Y_{t=a_{10}} + \sum_{i=1}^{k} a_{1i} LnY_{t-1} + \sum_{i=1}^{k} b_{1i} LnX_{t-i} + u_{1t} \quad (1)$$

$$\mathrm{Ln}Y_{t=a_{20}} + \sum_{i=1}^{k} a_{2i} LnY_{t-1} + \sum_{i=1}^{k} b_{2i} LnX_{t-i} + u_{2t} \quad (2)$$

The subscript t of each variable represents time, k represents the maximum lag length of the variable, and ut represents the random error term. According to the above formula, a Granger causality model between urbanization (lnURB), industrial structure (lnTS), and urban-rural income gap (LnIG) is established. The test results are shown in Table 2:

The test results in Table 2 show that with a lag of 2 periods and a 5% significance level, we can draw the following preliminary conclusions through the Granger causality test:

First, the null hypothesis "lnTS is not the Granger cause of lnIG" has a P value of 0.0764. When the significance level is 10%, the null hypothesis is rejected, that is, industrial advancement is the Granger cause of the widening of the urban-rural income gap.

Second, the null hypothesis "lnURB is not the Granger cause of lnIG" has a P value of 0.02. When the significance level is 5%, the null hypothesis is rejected, that is, urbanization is the Granger cause of the widening of urban-rural income gap.

Table 2. Granger causality test of three variables of LnURB, LnTS and LnIG.

| Null hypothesis | F Statistics | P value | Test result |
|---|---|---|---|
| LNTS does not Granger Cause LNIG | 2.79146 | 0.0764 | Reject null hypothesis |
| LNIG does not Granger Cause LNTS | 0.99186 | 0.4233 | Not reject null hypothesis |
| LNIG does not Granger Cause LNURB | 0.07995 | 0.9235 | Not reject null hypothesis |
| LNURB does not Granger Cause LNIG | 4.90357 | 0.0200 | Reject null hypothesis |
| LNTS does not Granger Cause LNURB | 2.95238 | 0.0778 | Reject null hypothesis |
| LNURB does not Granger Cause LNTS | 4.42201 | 0.0274 | Reject null hypothesis |

Third, the null hypothesis "lnURB is not the Granger cause of lnTS" has a P value of 0.0274. When the significance level is 5%, the null hypothesis is rejected, that is, urbanization is the Granger cause of advanced industrial structure.

The same analysis shows that the advanced industrial structure is also the Granger cause of urbanization, so the two are complementary and mutually reinforcing.

## 2.5 Pulse analysis

We usually use the impulse response function (IPF) to analyze the response of each endogenous variable in the VAR model to the disturbance of itself and other endogenous variables, so as to understand the dynamic characteristics of the VAR model. This paper chooses the generalized impulse response analysis, and the results of the impulse response test between urbanization, industrial advancement, and urban-rural income gap (Figure 1 and Figure 2) are analyzed as follows.

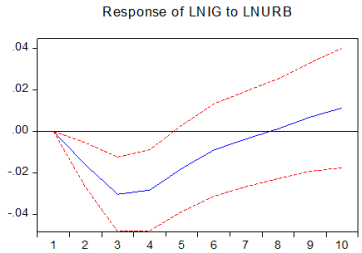


**Fig.1.** The response path of urbanization to the urban-rural income gap.

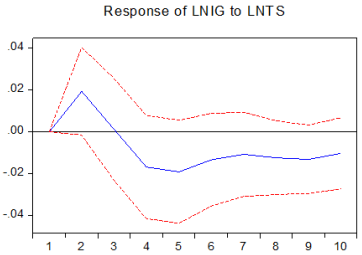


**Fig. 2.** The response path of industrial advancement to the urban-rural income gap.

Specifically, it can be seen from Figure 1 that after a positive impact on the URB in this period, the urban-rural income gap has a negative response from the beginning, which reaches the lowest point in the third period, and then starts to rise slowly. After the eighth period, it began to become a positive response and gradually stabilized, that is, initially with the process of urbanization, the urban-rural income gap will be gradually narrowed, but after the eighth period, the urban-rural income gap will gradually widen and eventually stabilize.

Figure 2 shows that after a shock to the urban-rural income gap, it initially showed a positive effect, which reached a peak in the second period, then gradually weakened, and turned to a negative effect in the third period, and then stabilized. That is, in the early stage, the advanced industrial structure will widen the urban-rural income gap, but in the later stage it will narrow the urban-rural income gap and maintain stability.

## 2.6 Analysis of variance

Variance decomposition uses variance to measure the contribution of each structural shock to the change of endogenous variables, and then evaluates the importance of different structural shocks. The variance decomposition method is used to analyze the contribution of each structural shock to the change of urban-rural income gap (lnIG). Table 3 shows the variance contribution of the urban-rural income gap spanning 10 periods. The conclusions are as follows.

**Table 3.** Contribution to the variance of the urban-rural income gap (lnIG).

| Periods | S.E. | LNIG | LNTS | LNURB |
|---|---|---|---|---|
| 1 | 0.034453 | 100.0000 | 0.000000 | 0.000000 |
| 2 | 0.049475 | 73.97609 | 15.31901 | 10.70489 |
| 3 | 0.058193 | 54.17619 | 11.11569 | 34.70813 |
| 4 | 0.066884 | 41.14010 | 14.72406 | 44.13584 |
| 5 | 0.072708 | 37.32398 | 19.37479 | 43.30123 |
| 6 | 0.076072 | 38.30625 | 20.77975 | 40.91400 |
| 7 | 0.077576 | 38.55064 | 21.89719 | 39.55218 |
| 8 | 0.078591 | 37.61977 | 23.81433 | 38.56590 |
| 9 | 0.080051 | 36.42209 | 25.64623 | 37.93168 |
| 10 | 0.081676 | 35.37977 | 26.23038 | 38.38984 |

First, the urban-rural income gap was most affected by itself in the initial stage, reaching 73.97% in the second period, then gradually declined and tended to converge, and remained at 35.38% in the tenth period, indicating that the urban-rural income gap has a strong path dependence, which cannot be fundamentally changed in the short term.

Secondly, the urban-rural income gap is greatly affected by urbanization, reaching 34.70% in the third period, and the peak of 44.14% in the fourth phase. Although it begins to converge since then, its influence is still higher than that of industrial advancement.

Finally, industrial advancement also has an impact on the urban-rural income gap, but it is slightly lower than that of urbanization. In the third period, it was only 11.12%. In the later period, it showed a slow upward trend and its influence continued to increase, reaching 26.23% in the tenth period. Overall, urbanization in Sichuan Province has the largest contribution rate to the urban-rural income gap, but its impact is declining. Although the contribution of industrial advancement is lower than that of urbanization, its impact is gradually increasing, and its role in the future cannot be underestimated.

## 3 Conclusions and policy recommendations

This paper selects three indicators of urbanization, industrial structure, and urban-rural income gap to construct a three-dimensional VAR model. Through Granger causality test, impulse response function, and variance decomposition, a dynamic analysis of the impact of urbanization and industrial structure on the urban-rural income gap in Sichuan is carried out. It shows that urbanization and industrial structure have an important impact on the urban-rural income gap in Sichuan Province. The urban-rural income gap is most affected by itself at the initial stage, and is strongly depended on the path, and cannot be fundamentally changed in the short term. In short period of time, the effect of urbanization on narrowing the urban-rural income gap is more obvious than that of industrial advancement. However, in the long run, the role of urbanization in narrowing the urban-rural income gap has a weakening trend. In contrast, the adjustment of the industrial structure is more effective in narrowing the urban-rural income gap, and the effect has been maintained at a stable level in the later period, and the trend is also predictable. Based on the above conclusions, the following policy recommendations are put forward for reducing the income gap between urban and rural areas in Sichuan Province:

First, Sichuan Province should vigorously develop a number of small and medium-sized towns with characteristics, so as to build a number of small and medium-sized towns relying on the development of the service industry as the main line, and transform the land urbanization model into a human-centric urbanization model. The primary task is to break the unequal system restrictions of household registration, housing, medical care, education, employment, and social security under the urban-rural dual system, and create conditions and innovative methods to promote the citizenization of migrant workers and the migration and settlement of rural students from colleges and universities. It should not over-bias resources to big cities. It is suggested to use the radiation role of small towns to drive the economic development of surrounding rural areas, increase investment in education in small towns, and improve the employability of rural residents.

Second, promote the development of "industry-city integration". During the construction of a new type of urbanization, it must vigorously develop secondary and tertiary industries that are compatible with the level of urbanization. The development of urbanization can provide talents and technology for industrial upgrading, and industrial restructuring can absorb surplus labor in rural areas, promote labor transfer, increase farmers' income levels, and narrow the urban-rural income gap.

Third, promote the adjustment of the industrial structure and inject vitality into the economic development of Sichuan Province with advanced industrialization. As a major province of tourism and agriculture, Sichuan Province has a large share of agriculture, while manufacturing and service industries have a low share. When adjusting the industrial structure, it must transform to modern agriculture, advanced manufacturing and modern service industries, and adopt technological innovation, introduction of talents, and policy support to promote industrial optimization and upgrading, vigorously develop emerging industries, and provide a broad space for labor transfer.

## References

1. Zhang Lin, Lian Yonghui. Real Exchange Rate, Industrial Structure and Urban-rural Income Gap [J]. Journal of Xi'an Jiaotong University (Social Science Edition), 2013, 33(06): 7-15.
2. Gong Xinshu, Zhang Hongzhen, Wang Yan, Pan Mingming. Research on Industrial Structure Upgrading, Urbanization and Urban-rural Income Gap

3. Soft Science, 2018, 32(04): 39-43.
4. Dong Chun, Zhang Hongli. The Spatial and Temporal Heterogeneity of the Impact of Urbanization and Industrialization on the Urban-rural Income Gap in Sichuan Province[J]. Finance and Economics, 2018(06): 80-93.
5. Wan Chaoyang, Wang Donghong. Research on the Impact of Urbanization and Industrial Structure Adjustment on the Income Gap between Urban and Rural Residents[J]. China Business Review, 2018(16): 164-165.
6. Mu Huaizhong, Wu Peng. Urbanization, Industrial Structure Optimization and Urban-rural Income Gap [J]. Economist, 2016(05): 37-44.
7. Peng Dingyun, Zhang Feipeng. Research on the Relationship between Urbanization, Industrial Structure and Urban-rural Income Gap [J]. Industrial Technology Economy, 2017, 36(10): 55-62.