Dynamic Analysis of Population Migration and Industrial Structure in Gansu Province China

Haiying Ma

School of Economics, Northwest University for Nationalities Lanzhou (730124), P. R. China,

lxmahaiying8888@163.com

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Abstract. With the development of urbanization progress and industrial structure, Gansu province has experienced a rapid and unprecedented process of rural–urban migration. Based on the time series data 1978-2011 in Gansu province, this paper attempts to present the VAR model of rural-urban migration and industrial structure change and analyzes the dynamic effect between rural-urban migration and industrial structure change in Gansu province. The result shows that rural-urban migration and industrial structure change is dynamically interacted with mutual influence from spatial evolution. Additionally, the impact of industrial structure change on rural–urban migration is stronger than that of rural–urban migration on industrial structure change. Therefore, the pace and scale of the migration and industrial structure should be determined by and consistent with economic development levels, and the local government should be prepared to deal with increasing migrants in the near future due to potential growing rural–urban gap.

Introduction

Economic growth almost inevitably leads to substantial movement of labor from the rural agricultural sector to secondary and tertiary industries and adjusts the transformation of industrial structure. As a result, the population gradually concentrated on the urban areas. At the same time, the improvement of urbanization level generates agglomeration effects with the concentration of population and takes a great deal of externalities on the secondary and tertiary industry. Therefore, the mutual mechanism researches between the rural-urban migration and industrial structure change is of great significance for the economic development, especially for less developed area.

The study with respect to the relationship between the rural-urban migration and industrial structure began 1950s. Most research focused on the subjects such as development economic, economic growth theory, regional economics and industry economics. William Petty [1] pointed out characteristics labor force flow between the industries in the studying the fluctuation rules of industrial structure. Clark [2] found the rules of population migration in industries and distribution of migration for the first time by using three industries classification, and revealed the basic direction of the evolution of industrial structure and economic development. After the 1970s, the "standard industry structure" has widened the influence. Chancery [3] has carried on the empirical research on the correlation of industrial structure and labor movement path of each economic growth period. After that, Enright [4] stated that geographical concentration of industry will produce obvious accumulation effect, beneficial to the improvement of the competitiveness of industry cluster to promote the interactive development of regional industrialization. In China, Lu [5] examined how economic conditions influence inter-provincial migration. Wang *et al.* [6] pointed out that China's widened urban-rural divide arises from the socialist industrialization process, which creates a hastened heavy-industrial base at the expense of its rural population. The rural-urban gap in social and economic well-being, together with a massive reservoir of rural surplus labor and an acute shortage of consumer goods, formed the driving forces of China's change of migration-control policy and the rapid increase of rural migrants in Chinese cities [7-10].

The above studies show that there is interactive effect between rural-urban migration and industrial structure, but is mostly qualitative analysis and static method, the relationship between the process of

migration and industrial structure evolution research mainly focus on the dynamic mechanism of urbanization transformation, qualitative analysis and the regression model can't response of the industrial structure and migration under the mutual impact of the variables dynamic change process. Based on the vector autoregressive model (VAR), this paper present the dynamic relationship between rural–urban migration and industrial structure change, the migration process are studied by using impulse response function for the dynamic effect of industrial structure change, variance decomposition method can be used to explain dynamic contribution of industrial structure change on migration as well as the summary and explanation for the dynamic effect between them.

Data and Methodology

Vector autoregressive model (VAR) is often used to forecast time series of interconnected system, and analysis of random disturbance on the variable system dynamic effect. VAR method through each endogenous variable in the system as all the lag value of the endogenous variable in the system function to construct the model, thereby avoiding the need for a structured model. Mathematical model of a VAR (P) is:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B x_t + \varepsilon_t \tag{1}$$

Where y_t an endogenous variable, k d is, x_t are exogenous variables. $A_1, \cdots, A_p$ and B is to be estimated coefficient matrix. ε_t is disturbance vector, they can at the same time related with each other, but not associated with the lag value of themselves and not associated with the variables of on the right side of the equation.

Impact to the i variable not only directly affect the i variable, and through the dynamic structure of the VAR model to all other endogenous variables. Impulse response function is drawn in a disturbance with a one-time shocks, the endogenous variable of the effects of the current value and future value.

The $VMA(\infty)$ expression of y_t is:

$$y_t = (\psi_0 I + \psi_1 L + \psi_2 L^2 + \cdots)\varepsilon_t \tag{2}$$

If the $VAR(p)$ reversible, the VMA coefficient of y_t can be obtained by the coefficient of VAR. Set $\psi_q = (\psi_{q,ij})$, $q = 1, 2, 3, \ldots$, the y_{it} is:

$$y_{it} = \sum_{j=1}^{k} (\psi_{0,ij}\varepsilon_{jt} + \psi_{1,ij}\varepsilon_{jt-1} + \psi_{2,ij}\varepsilon_{jt-2} + \psi_{3,ij}\varepsilon_{jt-3} + \ldots) \tag{3}$$

Therefore, in general, the response functions of y_i caused by pulse of y_j can be calculated as follows:

$$\psi_{0,ij}, \psi_{1,ij}, \psi_{2,ij}, \psi_{3,ij}, \psi_{4,ij}, \ldots \tag{4}$$

The change of industrial structure is characterized as dynamic process. In order to better understanding the dynamic process, the data of rural-urban migration 1978-1985 can be found from the Labor Affairs Office, People's Government Gansu, and this number 1986-2011 can be utilized by the research project by Wang (2012 Gansu Academy of Social Sciences). GDP in this paper are selected from China Statistic Yearbook (2012). Industrial structure can be defined as the output value structure of three industrials and the variable illustrates the change of industrial structure. In this paper, UR is denoted to rural-urban migration, IS_1, IS_2, IS_3 stands for proportion of value added of Primary industry, secondary industry and tertiary industry to GDP.

Empirical Analysis

ADF Unit Root Test. ADF unit root test is the examination of data sequence, if there is a same smooth order, the co-integration test can applied on them. As test results in table 1 shows, all level variable sequences accepted the original hypothesis has a unit root, but the first order difference sequence of

four variables under 1% significant declined to the original hypothesis also has a unit root, namely I (1) time series, the co-integration test will conducted.

Table 1 ADF unit root test

variable	Test Type（C, T,K）	ADF value	5% critical value	1% critical value	P value
$LNUR$	(C,T,1)	-1.45	-3.56	-4.24	0.7602
$\Delta LNUR$	(C,0,0)	-3.81	-2.86	-3.85	0.0050
$LNIS_1$	(C,T,0)	-2.77	-3.55	-4.26	0.2527
$\Delta LNIS_1$	（C,0,0）	-5.22	-2.86	-3.75	0.0001
$LNIS_2$	(C,T,0)	-2.09	-3.59	-4.24	0.5383
$\Delta LNIS_2$	（C,0,0）	-5.32	-2.86	-3.75	0.0002
$LNIS_3$	(C,T,0)	-1.77	-3.55	-4.20	0.5827
$\Delta LNIS_3$	（C,0,0）	-5.20	-2.97	-3.35	0.0002

Co-integration Test. The purpose of the co-integration test is to determine a set of stable sequence, which is observed whether the long-term equilibrium relationship between variables existed. As test results in Table 2 shows, Johonsen co-integration test results shows that there is a co-integration relationship between variables, the trace statistic test and the maximum characteristic value of test showed there are at least two collaborators whole relations under the 5% significant, comply with the requirements for the VAR model.

Table 2 Johonsen co-integration test

Cointegration vector number	Characteristic root value	Trace Statistics	5% critical value	P value	maximum characteristic value	5% critical value	P value
None*	0.7778	72.4201	48.8561	0.0002	34.1634	27.5843	0.0061
At most 1*	0.5296	44.2566	29.9770	0.0143	23.3824	21.3116	0.0237
At most 2	0.2915	10.9942	15.3547	0.2193	10.2495	14.3446	0.1961
At most 3	0.0189	0.6247	3.84146	0.4293	0.6247	3.8415	0.5273

The Establishment of the VAR Model. According to the AIC and SC criteria to determine the optimal lag order number is 2, according to the type (2) to establish the VAR (2) as follows:

$$\begin{bmatrix} LNUR_t \\ LNIS1_t \\ INIS2_t \\ LNIS3_t \end{bmatrix} = \begin{bmatrix} 1.05 & -0.21 & -0.65 & -0.39 \\ -0.52 & 0.90 & 1.21 & 0.63 \\ 0.10 & -0.12 & 0.24 & -0.33 \\ -0.08 & -0.13 & -0.73 & 0.41 \end{bmatrix}\begin{bmatrix} LNUR_{t-1} \\ LNIS1_{t-1} \\ INIS2_{t-1} \\ LNIS3_{t-1} \end{bmatrix} + \begin{bmatrix} -0.02 & -0.19 & -0.38 & -0.25 \\ 0.18 & 0.53 & 0.82 & 0.51 \\ -0.05 & -0.06 & 0.07 & 0.06 \\ 0.32 & -0.45 & -1.06 & -0.77 \end{bmatrix}\begin{bmatrix} LNUR_{t-2} \\ LNIS1_{t-2} \\ INIS2_{t-2} \\ LNIS3_{t-2} \end{bmatrix} + \begin{bmatrix} -2.08 \\ 3.06 \\ -1.07 \\ -3.46 \end{bmatrix}$$

Impulse Response Function Analysis. Impulse response function description is an endogenous variable of VAR the effects of shocks to other endogenous variables. Fig. 1 shows the rural-urban population migration impact caused by the three industrial structure of the impulse response, the figure of the horizontal axis shows the impact of migration lag periods, the pulse response of the longitudinal axis of each industry proportion variable, figure in implementing line shows the impulse response function size, states two times the standard deviation of plus or minus deviation with dotted lines. Fig. 2 shows the level of migration impact on the effect of three industry. When the migration level have a positive impact, in the first period of the first industry is effect to peak, followed by continuous attenuation. In the second period to the influence of the negative effect, after the 4 basic it remains stable, shows that in the long term the improvement of migration level to reduce the proportion of

primary industry, and the influence of the negative effect is gradually enhanced. The proportion of secondary industry on the impact of migration level is positive effect in the initial reaction, and shows a trend of increase. In the second phase it reaches to peak, then gradually decay, positive effect after 5 basic stable, long-term in the improvement of migration level on increase the proportion of secondary industry has the effect of long-term support. Finally, after have a positive impact on the third industry, the effect of initial is negative, but there is a growing trend, in the third period to positive effect, and in the fourth period it once again reaches to peak, then remain stable. The analysis shows that in the long term the improvement of migration level to drive the proportion of the tertiary industry.
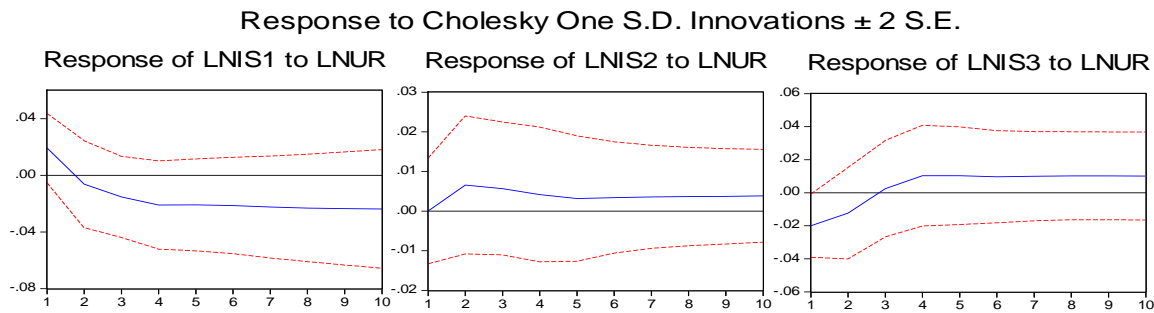

Figure 1. Pulse response output of industrial structure transfer from the impact of urbanization

Conclusions

From the rural-urban migration in Gansu province and historical data of industrial structure change, the migration and industrial structure change are interrelated and influence each other, and this effect is dynamic and has been developing. Change continuously promoting the migration level of industrial structure, industrial structure transformation is an important driving force of urbanization, and urbanization have played a role for the industrial structure change, speeding up the deepening of the industrial structure and depth. The change of industrial structure is the necessary path for the economy to improve production efficiency, it is one of the most important aspects of the economic development and migration, both has the important relation, the migration can be used as a means of accelerating industrial structure change. Migration in Gansu province based on the reality of weak influence on the industrial structure change and should pay attention to the urbanization process to promote the industrial structure change.

Acknowledgements

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