

## Urbanization, Industrialization and Urban-Rural Income Gap: Inspection by Panel VAR Based on the Provincial Panel Data

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**Support** by the Research and Innovation Project of Chongqing Graduate Students “the Urban-Rural Income Gap in the View of Human Capital”(CYS2015062); the National Social Foundation of China “Research on the Construction of New Agricultural Management and the Innovation of Financial Support for Agriculture”(14BJY125).

Received 20 October 2015; accepted 18 December 2015  
Published online 26 February 2016

### Abstract

This paper put urbanization, industrialization and urban-rural income gap in a system model, analysis the dynamic interaction mechanism between urbanization, industrialization and urban-rural income gap. Inspection by Panel VAR based on the provincial panel data of 31 provinces and cities in China from 1997 to 2013. The research shows that there is obviously nonlinear relationship between urbanization and urban-rural income gap, but in the long run, urbanization is conducive to narrow the urban-rural income gap; there is benign circulation interactive relation between industrialization and urban-rural income gap; in the long run industrialization and urbanization are not conducive to the development of each other.

**Key words:** Urbanization; Industrialization; Urban-rural income gap; Panel VAR

Zhang, N. (2016). Urbanization, Industrialization and Urban-Rural Income Gap: Inspection by Panel VAR Based on the Provincial Panel Data. *Studies in Sociology of Science*, 7(1), 1-6. Available from: URL: <http://www.cscanada.net/index.php/sss/article/view/8009> DOI: <http://dx.doi.org/10.3968/8009>

### INTRODUCTION

During 30 years of opening up and reform, with the rapid economic growth and the continuous improvement of the

income level of residents, China's economy also shows a series of problems, urban and rural binary economy structure becoming increasingly prominent, growing income gap between urban and rural, urbanization lags behind industrialization etc. such problems have affected the healthy development of China's economy. Urbanization and industrialization are the inevitable way for developing countries to change from traditional agricultural society to modern industrial society, and urbanization is the engine of the sustainable development of economy, is the inevitable way to reduce the income inequality between urban and rural, and also the key to change China's economic development mode and further development of “new four modernizations”. Among the many factors that affect the growing income gap in china, urban-rural income gap is the biggest contribution, investigate its reason that urban and rural binary economy structure is the important factor which lead to growing income gap between urban and rural, China's urban-rural income gap reached the maximum in 2009 of 3.3:1, the minimum value reached 1.9:1 in 1985, this is to benefit from the beginning of the rural reform in 1978, over the past 30 years, although the urban-rural income gap appears short-term reduction fluctuations trend. But on the whole it shows a trend of continuous expansion (Khan et al., 1998) from 2.5:1 in 1978 rose to 3.0:1 in 2013, if consider the medical subsidies, education, housing, pension and other subsidies for urban residents, urban-rural income gap will be bigger (Li & Ding, 2003). At the same time, China's urbanization rate and the industrialization rate has shown a growing trend, China's urbanization rate rose from 18% in 2013 to 54% in 1978, an average annual increase of 0.91 percentage points, and since the reform and opening up, China's industrialization has also achieved rapid development, industrialization rate attaining 40% in general. Present stage, China also has a high urbanization rate, high industrialization rate and high urban-rural income gap, this shows that

urbanization and industrialization has not formed a good interactive relationship in the process of changing from traditional agricultural society to modern industrial society, in addition, China's long-term existence of urban and rural binary economy structure hindered benign flow of elements and capital between urban and rural areas. At present, China's economy has entered a new normal stage of medium-to-high growth from high growth, explore the dynamic relationship and its internal mechanism between urbanization, industrialization and urban-rural income gap has an important significance to China's economic development.

## 1. LITERATURE REVIEW

There is a two-way effect in China's urbanization and urban-rural income gap, the existing research is mainly divided into two categories: the change of urban-rural income gap in the process of urbanization and the impact of urban-rural income gap on urbanization. Among these, the impact of urban-rural income gap on urbanization have achieved a general consensus, reasonable urban-rural income gap is one of the reasons to improve the level of urbanization, moderate urban-rural income gap will promote the development of urbanization (Cheng & Li, 2007). However, there are great differences in the impact of urbanization on the urban-rural income gap, many scholars believe that the development of urbanization effectively promotes the narrowing of urban-rural income gap. Lin, Wang, and Zhao (2003) through the study of China's urban-rural labor floating, found that there is negative effect between urbanization and urban-rural income gap, that is the development of urbanization can narrow the urban-rural income gap. Mao (2011) use the generalized moment method empirically researched the impact of urbanization and the level of economic openness on the urban-rural income gap, based on the provincial panel data in China from 1995 to 2008, suggest that urbanization is the key factor to narrow the urban-rural income gap. But some scholars have found that the development of urbanization has expanded the urban-rural income gap. Barro and Sala-i-Martin (1995) through the study found that the development of urbanization has no significant effect on narrowing the income gap between urban and rural areas, based on the theory of population migration. Wang and Cai (2006) suggest that due to the different degree of education and other factors, in the process of transfer of workforce and population from rural to urban areas, often those with higher incomes rural population into the urban, so in certain degree expand the urban-rural income gap. Luo (2012) research found that urbanization preferring larger and medium-sized cities can widen urban-rural income gap, based on the provincial panel data of 31 provinces and cities in China from 1978 to 2008. But some scholars have studied that there has uncertainty relationship between urbanization and urban-

rural income gap. Wu (2014) proved that the level of urbanization has a nonlinear effect on urban-rural income gap, when the level of urbanization is below 34.77%, urbanization is conducive to narrowing the income gap between urban and rural areas, and when between 34.77% and 53.49%, urbanization has a lower degree of convergence of urban-rural income gap, and when exceed 53.49%, is not conducive to narrowing the income gap between urban and rural areas. Wang et al. (2015) further comprehensive considered that under different stages of urbanization and different levels of urban-rural income gap, the impact of urbanization on urban-rural income gap has nonlinear effect.

About the factors of urban-rural inequality, scholars have carried out the research from many angles, among this industrialization is also an important reason for the impact of urban-rural inequality. In the process of industrialization developing countries can absorb the surplus rural labor force to change the employment structure and labor productivity and then promote the peasant revenue, indirectly narrow the urban-rural income gap. Ma (2005) suggests that at all stages of industrialization development in China, because of the different productivity level and the input factors between urban and rural, the urban-rural income gap will be widened. Chen (2010) researched the relationship between urbanization, industrialization and urban-rural income gap by constructed the SVAR model based on the provincial panel data in China from 1998 to 2008, research shows that the development if industrial in the short term expanded the urban-rural income gap, but as time grows industrialization will accelerate the narrowing of the income gap between urban and rural areas. Chuan (2008) used simultaneous equations model empirical researched the relationship between urbanization, industrialization and urban-rural income gap from the perspective of endogenous dynamic system, found there is a vicious spiral state between industrialization and urban-rural income gap. Many scholars studies also show that the development of urbanization and industrialization is the key factor to improve the income level of farmers and then reduce the income gap between urban and rural areas.

Summary the above literature, many scholars have studied the influence factors of the urban-rural income gap from two angles of urbanization and industrialization, and draw different conclusions, most of the studies are focused on the unilateral influence relationship between urbanization ,industrialization and urban-rural income gap, more about static analysis in research methods. However there is a two-way interactive relationship between urbanization, industrialization and urban-rural income gap, for this reason, this paper use the provincial panel data of 31 provinces and cities in China from 1997 to 2013, put urbanization, industrialization and urban-rural income gap in a system model, based on panel VAR analysis the dynamic interaction mechanism between

urbanization, industrialization and urban-rural income gap.

## 2. MODEL, METHOD AND DATA

### 2.1 Model and Method

VAR model uses the multi-equation simultaneous form, overcome the limitation of the traditional simultaneous equations model, panel VAR is proposed by Holtz-Eakin (1998), after the development of Love Inessa (2006), panel VAR method combines the advantages of both panel data and vector auto regression model, it not only reduce the multiple linear and internal problems in the traditional time series VAR model but also effectively controlling the cross section difference between the samples. Consider the impact of urbanization, industrialization and urban-rural income gap is not only a one-way, there may exist mutual dynamic mechanism between the three. This paper inspection by Panel VAR based on the provincial panel data of 31 provinces and cities in China, analysis by the following three steps: First, moment estimation (GMM) for panel VAR model to reveal the interaction between variables; Second, through variance analysis, illustrates the contribution of shock response of different VAR equation to the fluctuation of endogenous variable; Third, through impulse response analysis, intensive study the dynamic effects of a variable to another at different times, observe the response of the variables to impact. Based on this, construct the following analysis model:

$$\mu_0 y_{i,t} = \sum_{j=1}^k \mu_j y_{i,t-j} + \lambda_i + \theta_t + \varepsilon_{i,t} .$$

Among them,  $i$  represents the province,  $t$  represents year;  $\mu_0$  is variable correlation matrix,  $y_{i,t}$  is endogenous variable matrix;  $y_{i,t-j}$  is the explanatory variable matrix of the composition of the lag term in the internal variable,  $\mu_j$  is the estimation matrix of lag  $j$ ,  $\lambda_i$  is a fixed effect that reflects the differences between provinces,  $\theta_t$  indicates that the time fixed effect does not change with the region,  $\varepsilon_{i,t}$  is random error term.

### 2.2 Indicator Definitions and Data Description

Urbanization (urb): Use the measurement method of the mainstream literature, use the ratio of resident population to total population to measure, the higher the ratio, the higher the level of urbanization.

Industrialization (ind): The total output value of industry accounted for the proportion of GDP to measure, the higher the ratio, the higher the level of industrialization of a region.

Urban-rural Income Gap (gap): Use the ratio of disposable income of urban residents to per capital annual net income of rural residents, the higher the ratio, the greater the urban-rural income gap.

In the empirical analysis, based on the provincial panel data of 31 provinces and cities in China from 1997

to 2013, all the original data come from “Statistical yearbook of china”, “Provinces (autonomous regions and municipalities) statistical yearbook (over the years)”, “New China sixty years of statistical data compilation”. The descriptive statistics of the data are as follows:

**Table 1**  
**Descriptive Statistics of Variables**

	urb	ind	gap
Mean	0.410682	0.378359	2.921257
Median	0.385600	0.397500	2.837100
Maximum	0.896000	0.530400	5.103200
Minimum	0.171800	0.070300	1.599200
Std. Dev.	0.164521	0.096898	0.649393
Skewness	0.988071	-1.145664	0.666327
Kurtosis	3.661084	4.331966	3.255035
Jarque-Bera	95.34682	154.2422	40.42553
Probability	0.000000	0.000000	0.000000
Sum	216.4293	199.3951	1539.503
Sum Sq. Dev.	14.23735	4.938778	221.8204

## 3. PANEL VAR YEST AND ANALYSIS

### 3.1 Panel GMM Estimation

In the panel VAR analysis, in order to avoid the possible individual effect in the model, Helmert method is used to forward difference for all the variables, the choice of the lag order of the model was determined by AIC, BIC and HQIC criteria, the optimal lag order is 3, the estimated coefficients of all variables are at least 10% of the significant level, Panel CMM estimation results are shown in Table 2. First, Urban-rural income gap (gap) as the dependent variable, lag 3 order of other variables as independent variables, estimates show that the dynamic response of the urbanization to urban-rural income gap is negative in lag phase 1, estimated coefficient is -0.3665, the dynamic response become positive in lag phase 2 is 0.4209, but the dynamic response become negative in lag phase 3 is -0.2379. This shows the development of urbanization has a nonlinear effect on the income gap between urban and rural areas, in the early stage of urbanization the development of urbanization will narrow the urban-rural income gap, and with the further advance of urbanization, when it reaches the middle stage, the development of urbanization will expand the urban-rural income gap, but when the urbanization reaches saturation stage urbanization has a convergence effect on urban-rural income gap; the dynamic response of industrialization to urban-rural income gap is always negative, but its effect is gradually weakened with the extension of the period, in lag phase 1 is -0.2757, lag phase 2 is -0.0706, lag phase 3 is -0.0466. This shows the development of industrialization promotes the narrowing of the income

gap between urban and rural areas in a long term, but this convergence effect will gradually become weaker with the extension of time.

Second, Urbanization(urb) as the dependent variable, lag 3 order of other variables as independent variables, the estimates show that the dynamic response of urban-rural income gap to urbanization is negative in lag phase 1, estimated coefficient is -0.1050, the dynamic response become positive in lag phase 2 and 3, are 0.0480, 0.0226, we can see in a short time there is inhibitory action between urban-rural income gap and urbanization, but in the second period and the third period appropriate urban-rural income gap is helpful for the development of urbanization, proved there is a nonlinear relationship between urban-rural income gap and urbanization; the impact of industrialization on urbanization is negative in lag phase 1, the reaction value is -0.2542, the impact become positive in lag phase 2 is 0.1236, but the impact become negative in lag phase 3 is -0.0665, shows in the early and saturation stage of industrial development, there

is inhibitory action on urbanization, but in the middle stage industrialization development has certain promotion effect on the promotion of urbanization, and this effect can be weakened by the length of time.

Finally, Industrialization(ind) as the dependent variable, lag 3 order of other variables as independent variables, the estimates show that the impact of urban-rural income gap on industrialization is negative in the first period, and become positive in the second and third period, which are -0.0116, 0.013, 0.0024, shows the urban-rural income gap has obvious stage characteristics of industrialization, in the early stage the expansion of urban-rural income gap can inhibit the development of industrialization, with the extension of time the expansion of urban-rural income gap is beneficial to the development of industrialization; the impact of urbanization on industrialization is always negative, in lag phase 1 is -0.0016, lag phase 2 is -0.0037, lag phase 3 is -0.0153, proved the development of urbanization is not conducive to industrial development.

**Table 2**  
**Results of VAR Moment Estimation**

Dependent variable	gap			urb			ind			
	Statistic	b_GMM	se_GMM	t_GMM	b_GMM	se_GMM	t_GMM	b_GMM	se_GMM	t_GMM
L1.gap		1.1232	0.1392	8.0700	-0.1050	0.0848	-1.2400	-0.0116	0.0160	-0.7300
L1.urb		-0.3665	0.1693	-2.1600	0.8870	0.0560	15.8300	-0.0016	0.0258	-0.0600
L1.ind		-0.2757	0.7250	-0.3800	-0.2542	0.3145	-0.8100	1.1197	0.0961	11.6500
L2.gap		-0.1828	0.0858	-2.1300	0.0480	0.0498	0.9600	0.0137	0.0109	1.2600
L2.urb		0.4209	0.1534	2.7400	0.0020	0.0511	0.0400	-0.0037	0.0200	-0.1800
L2.ind		-0.0706	0.5166	-0.1400	0.1236	0.1222	1.0100	-0.1731	0.0889	-1.9500
L3.gap		-0.0218	0.0634	-0.3400	0.0226	0.0174	1.3000	0.0024	0.0070	0.3400
L3.urb		-0.2379	0.1119	-2.1300	-0.0047	0.0318	-0.1500	-0.0153	0.0144	-1.0600
L3.ind		-0.0466	0.2991	-0.1600	-0.0665	0.0675	-0.9800	-0.0303	0.0479	-0.6300

### 3.2 Panel Variance Decomposition

In order to explain the interactive influence between urbanization, industrialization and urban-rural income gap more precise, analyze the contribution of each structural shock to the change of endogenous variables, to evaluate the importance of different structural shocks. Based on the VAR estimation, this paper further does variance decomposition based on panel data. The results of 5, 10, 15, and 20 forecast periods are selected, as shown in Table 3. The result shows that the fluctuation of urbanization, industrialization and urban-rural income gap mainly come from their own inertia impact, specifically: First, the impact of urbanization and industrialization on urban-rural income gap is gradually increasing with the period, in the forecast period of 5, 10, 15, and 20 the contribution of urbanization are 1.2%, 3.3%, 4.9%, 5.8%, and the contribution of industrialization are 1%, 3.5%, 4.8%, 5.4%, shows the impact of urbanization and industrialization on urban-

rural income gap has lagged effect, with the extension of time the impact of both on the urban-rural income gap is gradually increasing; Second, the impact strength of urban-rural income gap on urbanization is maximum than other variables and have grown steadily, in the forecast period of 5, 10, 15, and 20 the contribution of urban-rural income gap are 30.3%, 41.8%, 48.8%, 53.5%, but the contribution of industrialization to urbanization increased at first and then decreased with time, in the forecast period of 5, 10, 15, and 20 the contribution of industrialization are 2.2%, 3.9%, 4.0%, 3.5%, proved the development of urbanization is mainly influenced by its own and urban-rural income gap, the impact of industrialization on urbanization is small; finally, the contribution rate of urbanization and urban-rural income gap to industrialization are relatively small, but with the extension of the period, the influence gradually increased, in the forecast period of 5, 10, 15, and 20 the contribution of urban-rural income gap are. 2%, 4.9%,

15.3%, 25.7%, and the contribution of urbanization are 1.7%, 5.7%, 10.2%, 13.5%, by comparison, the impact of

urban-rural income gap on industrialization is greater than urbanization.

**Table 3**  
**The Results of Panel Variance Decomposition**

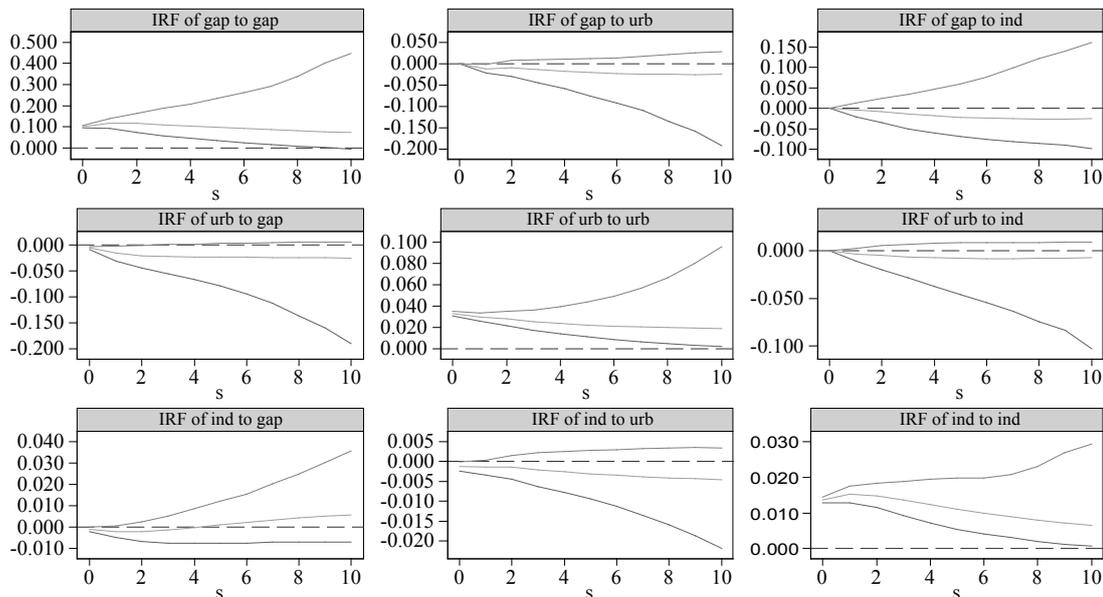
Variable	Period	gap	urb	ind	Variable	Period	gap	urb	ind
gap	5	0.978	0.012	0.010	gap	15	0.903	0.049	0.048
urb	5	0.303	0.675	0.022	urb	15	0.488	0.472	0.040
ind	5	0.012	0.017	0.971	ind	15	0.153	0.102	0.745
gap	10	0.932	0.033	0.035	gap	20	0.888	0.058	0.054
urb	10	0.418	0.543	0.039	urb	20	0.535	0.430	0.035
ind	10	0.049	0.057	0.894	ind	20	0.257	0.135	0.608

**3.3 Impulse Response Analysis**

In order to further analyze the impact factors and depth inquiry in the case of other factors remain unchanged, how dynamic effect of one factor on another, the paper analyzed the impact response function of the system equation, and use Carlo Monte to simulate 500 times, results as shown in Figure 1. First, the impact of urbanization on urban-rural income gap is negative, and after the first phase it tends to be stable, indicate the expansion of urban-rural income gap can inhibit the development of urbanization, but as time goes by the confidence interval becomes more and more large, the significant level of impact response becomes unreliable; the impact of industrialization on urban-rural income gap is always negative, with the extension of time the impact of the shock response is increased slowly and finally stabilized. This shows the expansion of urban-rural income gap will inhibit the development of industrialization. Second, the impact of urban-rural income gap on urbanization is not obvious,

its impact reaction line coincide with 0; the impact of industrialization on urbanization is negative, but the reaction is small and relatively stable. Finally, the impact of urban-rural income gap on industrialization is negative and gradually reduce, and in the fourth phase become 0, subsequently the impact response becomes positive and gradually increased, this shows that the development of industrialization will indeed affect the urban-rural income gap and the influence is subject to periodic changes, in early stage industrial development will promote the narrowing of the income gap between urban and rural areas, but this promotion is gradually weakened and converted into inhibition, in the later stage industrial development will inhibit the narrowing of the income gap between urban and rural areas; the impact of urbanization on industrialization is always negative and there is a trend of continuous reduction and the impact will become stabilized after reach the minimum value in the eighth period. Overall, the promotion of urbanization is not conducive to industrial development.

Impulse-responses for 3 lag VAR of gap urb ind



Errors are 5% on each side generated by Monte-Carlo with 500 reps

**Figure 1**  
**Panel Impact Response Diagram**

## CONCLUSIONS AND POLICY RECOMMENDATIONS

On the basis of analysis the inner function of urbanization, industrialization and urban-rural income gap, this paper put urbanization, industrialization and urban-rural income gap in a system model, analysis the dynamic interaction mechanism between urbanization, industrialization and urban-rural income gap, inspection by Panel VAR based on the provincial panel data of 31 provinces and cities in China. The research indicates that: (a) There is a nonlinear characteristic of urbanization and urban-rural income gap, in the early and saturation stages of urbanization, the development of urbanization will narrow the income gap between urban and rural areas, but in the middle stage it has an inhibitory effect on urban-rural income gap; conversely, the impact of urban-rural income gap on urbanization also has a nonlinear characteristic, in the early period, the urban-rural income gap inhibits the development of urbanization, and with the extension of time, appropriate urban-rural income gap is conducive to the development of urbanization. (b) The development of industrialization has promoted the narrowing of the income gap between urban and rural areas in a long term; Conversely, urban-rural income gap hinders the development of industrialization in short term but in long term urban-rural income gap greatly promote the development of industrialization, they are positive feedback relationship. (c) The development of industrialization and urbanization has a nonlinear effect, in the early and saturation stages of industrialization it inhibits the development of urbanization, in the middle stage industrialization promotes urbanization, but urbanization is not conducive to the development of industrialization.

The policy recommendation is proposed basing on the findings: (a) Further promote the development of urbanization, promote a virtuous circle between urbanization and urban-rural income gap. China is in the middle stage of urbanization, although the development of urbanization expand the urban-rural income gap in a certain extent, however the development of urbanization has lagged effect on urban-rural income gap, so government must adhere to promote the development of urbanization, optimize the allocation structure of resources in urban and rural areas. (b) Discard the barrier of dualistic urban-rural Structure, promote the process of urban-rural integration, let the rural residents share the fruits of industrialization, gradually establish the benign circulation market system of bidirectional free flow of factors between urban and rural areas, so the factors can reasonable allocation between urban and rural areas, pay attention to fairness in the initial income distribution, improve infrastructure construction and equalization of

public services between urban and rural areas. (c) Further promote the coordinated development between industry and agriculture to establish an interactive mechanism between them, implementation of industry nurturing agriculture, support rural development in policy, walk the right path of urbanization, industrialization and narrow the urban-rural income gap finally.

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