

Empirical Analysis of the Interactive Relationship Between Urbanization and Farmers' Income in Hebei Province of China: Based on VAR model

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Supported by Hundreds of Excellent Innovative Talents (1011004); Hundreds of Colleges and Universities in Hebei Province Outstanding Innovation Talented Person Project II (201308); Modern Agriculture's Province Development Research Center of Hebei.

Received 29 August 2015; accepted 17 October 2015

Published online 26 November 2015

Abstract

To study the relationship between urbanization and farmers' income in Hebei province, this paper uses the VAR model, Granger test, impulse response function and variance decomposition to the empirical analysis of the relationship, the results show that the urbanization and the farmers' income has a long-term positive equilibrium relationship; urbanization rate and farmers' income support each other, but the key is themselves.

Key words: Urbanization; Farmers' income; Relationship; VAR model

Zheng, S., Zong, Y. X., Zheng, T., & Chen, N. Y. (2015). Empirical Analysis of the Interactive Relationship Between Urbanization and Farmers' Income in Hebei Province of China: Based on VAR model. *Canadian Social Science*, 11(11), 6-11. Available from: <http://www.cscanada.net/index.php/css/article/view/7904> DOI: <http://dx.doi.org/10.3968/7904>

INTRODUCTION

"Three Rural" issues have been the core issue of the Party Central Committee "1". In 2015, the No.1 file of central

government stressed again to promote farmers' income and increase the policy support, so as to accelerate the integration of urban and rural development.

With the support of national policy on the "three rural" issue, the per capita net income of rural residents in Hebei province has achieved a rapid growth, increasing from 621.67 yuan in 1990 to 10,186 yuan in 2014, with a growth of 9,564.33 yuan, and the average annual growth rate is 12.36%. At the same time, the strong support of the national policy has effectively stimulated the development of urbanization. The urbanization rate in Hebei province increased from 14.37% in 1990 to 49.32% in 2014. Although there are fluctuations in the gap between the whole country on the urbanization rate, but the overall trend is shrinking, reducing from 12.04% in 1990 to 5.45% in 2014.

The level of per capita income and urbanization level are the important index to measure the level of economic development of a country or a region. With the held of work conference for promoting the new urbanization in Hebei Province and region, pertinence and validity development of planning project, urbanization has become a new engine for driving domestic demand, promoting economic development and improving people's living standards. Hebei province is in the process of accelerating urbanization currently, the urbanization rate has been a inundant trend, then does the rural residents income that is closely related to the urbanization have a synchronous development of gait? Therefore, this paper makes an empirical analysis of the relationship between urbanization and rural residents per capita net income in Hebei Province on the basis of VAR model, so as to offer a reference value to the formulation of the policy.

At present, the scholars have carried on a more comprehensive study on the urbanization and the income of residents. Yao (2012) analyze the relationship between urbanization and farmers' income in Sichuan through

co-integration analysis and error correction mode. The research shows that there is a long-term equilibrium relationship between the urbanization and the farmers' income in Sichuan. Urbanization has a significant and long-term impact on the per capita income of rural residents, the per capita cash income of rural residents, and the operating income of rural households in rural areas, but the impact on per capita net income and wage income of rural residents is not significant. Chen Haiyan and Chen Jiayang (2013) use the time series data of Chongqing in 1997-2012 and panel data from 34 counties in 2006-2011 to carry out dynamic analysis of the urban and rural income by establishing the co integration model and the autoregressive distributed lag model. The results show that there is a long-term equilibrium relationship between the development of urbanization and the increase of farmers' income in Chongqing. Duan and Yang (2014) conduct empirical analysis of the relationship between the level of urbanization and the income of urban and rural residents with the theory of co integration theory by using data from Anhui Province from 1996 to 2012. The results show that there is not only a long-term equilibrium relationship, but also a short-term equilibrium relationship between the level of urbanization and the income of urban and rural residents.

From the above literature we know, most scholars use the linear regression model and the co integration model, the premise of using least square method lacks of verification, and the results tests are not standardized, which may cause different degrees of deviation for the test results. At the same time, the co-integration model is only a one-way causal relationship. Based on this, this paper uses the VAR model to analyze the interaction between the two sides.

1. DATA SOURCES AND PROCESSING

Select the urbanization rate and per capita net income of rural residents in Hebei Province from 1990-2014 (Table 1, data come from Hebei Province Economic Statistical Yearbook (2014). As the rate of urbanization (urban population accounts for the proportion of total population) is the core indicator of the level of urbanization in a country or region, so choose the urbanization rate to reflect the level of urbanization in Hebei province; In order to reflect the increase or decrease of farmers' income, the average net income of rural residents is used to replace the income of farmers. In order to eliminate the possible different variance of time series data, the sequence number is represented as Lny , Lnx (Y expresses the rate of urbanization, X expresses the farmers' income).

Table 1
The Rate of Urbanization and the Per Capita Net Income of Rural Residents in Hebei Province in 1990-2014

Year	Urbanization rate in Hebei province %	Per capita net income of rural residents (yuan)	Per capita net income of rural residents (yuan)
1990	14.37	621.67	32.27
1991	14.54	657.40	35.73
1992	15.31	682.48	25.08
1993	15.64	803.80	121.32
1994	16.17	1107.25	303.45
1995	17.07	1668.70	561.45
1996	20.99	2055.00	386.30
1997	18.22	2286.01	231.01
1998	18.6	2405.32	119.31
1999	18.97	2441.50	36.18
2000	19.6	2478.86	37.36
2001	20.35	2603.60	124.74
2002	31.86	2685.16	81.56
2003	33.52	2853.38	168.22
2004	35.83	3171.06	317.68
2005	37.69	3481.64	310.58
2006	38.44	3801.82	320.18
2007	40.25	4293.43	491.61
2008	41.9	4795.46	502.03
2009	43	5149.67	354.21
2010	44.5	5957.98	808.31
2011	45.5	7119.7	1161.72
2012	46.8	8081.4	961.70
2013	48.2	9102	1020.60
2014	49.32	10186	1084.00

Data source: *Hebei Province Economic Statistical Yearbook* (2014).

2. VAR MODEL ANALYSIS

Vector auto regression (VAR) is a model based on the statistical properties of data. VAR model is used to construct the model of the system, which is used as a function of the lagged values of all endogenous variables in the system, thus, the single variable autoregressive model is generalized to the vector autoregressive model of multivariate time series.

The mathematical expression of VAR (P) model is:

$$y_t = \Phi_1 y_{t-1} + \dots + \Phi_p y_{t-p} + Hx_t + \varepsilon_t.$$

Where: y_t is the K dimensional variable column vector, x_t is vector column D dimensional exogenous

variables, P is the lag order number, the number of samples is T .

2.1 ADF (Stationary) Test

The phenomenon of false regression will appear in the process of fitting of the model, so the ADF (stationary) test was carried out by using EVIEWS8.0 software to ensure the validity of the VAR model. The lag phase and the test form are considered as the AIC, BIC, DW,

and the equivalent of the premise to determine the integrated. ADF unit root test results are shown in Table 2.

Refined Table 1 information we can know, the urbanization rate and per capita net income growth of rural residents are not stable, a stationary sequence is after the first order difference, so the two sequences are I (1) single and can be integrated with Johansen.

Table 2
Sequence ADF Test Results

Sequence	Inspection form	ADF test	Critical value			P value	Conclusion
			1%	5%	10%		
LN Y	(C,T,0)	-2.080433	-4.394309	-3.612199	-3.243079	0.5301	Unstable
DLN Y	(C,0,1)	-5.097255	-3.752946	-2.998064	-2.638752	0.0005	Stable
LN X	(C,T,0)	-2.659810	-4.416345	-3.622033	-3.248592	0.2602	Unstable
DLN X	(0,0,1)	-3.784093	-2.669359	-1.956406	-1.608495	0.0006	Stable

2.2 Johansen Test

Johansen test is a method to test regression coefficient on the basis of VAR model, and its put forward in 1988 and 1990 by Johansen and Juselius. It is a good method for multi variable co-integration test, which is used

to determine whether there is a long-term equilibrium relationship between sequences. We need to determine the optimal number of lagging steps before Johansen, from the Table 3 we know the optimal order of the delay is 2.

Table 3
Various Test Statistics for Lag 3 Period

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-36.76847	NA	0.116342	3.524406	3.623592	3.547771
1	1.594730	66.26370	0.005134	0.400479	0.698036	0.470575
2	9.630547	12.41899*	0.003603*	0.033587*	0.529515*	0.150412*
3	10.87867	1.701983	0.004766	0.283757	0.978057	0.447314

Note. The value of the symbol *represents the optimal choice for different order numbers.

According to the optimal lag order number, the lag phase of the Johansen trace test selects the 2 period, and the results are shown in Table 3.

Table 3
Johansen Trace Test Result

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob**
None*	0.517168	16.31712	15.49471	0.0375
At most 1	0.013509	0.299226	3.841466	0.5844

Analysis of data in Table 3 we know, rejects the original hypothesis of “no co integration equation”, accept the hypothesis that there is a maximum of a co integration equation, so there is a long-term co-integration

relationship under the 5% significant level.

Co-integration equation is:

$$Lny = 1.766015 + 0.284152Lnx.$$

This equation shows that there is a long-term equilibrium relationship between urban and rural residents' per capita net income growth, the average rate of urbanization increased by 0.284% with 1% increase of per capita net income.

2.3 Stability Test of VAR Model

The first step of VAR model analysis is to determine the stability of the VAR model by the root test of the stationary sequence, and then determine whether the Granger causality test, impulse response function and variance decomposition can be determined. If the root model is in a unit circle, it means VAR model is stable and can be improved by the test.

By Figure 1, the root modules are all in the unit circle, the VAR model is stable and we can carry out by other tests.

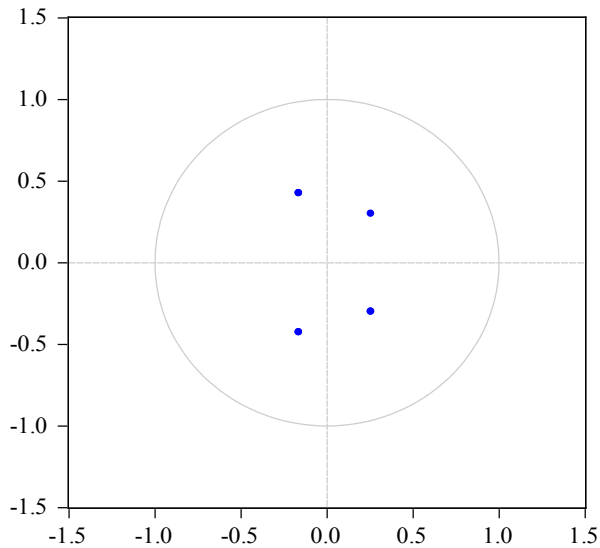


Figure 1
AR Characteristic Root Unit Circle

2.4 Granger Causality Test

The Granger causality test is essentially a test of whether a variable can be introduced into other variables. The original hypothesis was that x could not Granger cause Y.

If a variable is influenced by other variables, the correct expression method is "x Granger cause y". This does not mean that y is the result or the effect of X. The Granger causality test measures predicts on the Y, whether X's previous information contribute to the reduce on the mean square error MSE, and put this as a causal relationship between the judgment benchmark.

Table 4
Granger Causality Test

Variable	Original hypothesis	Statistic	Freedom	P value
Dlny	Per capita net income growth can not Granger cause the urbanization rate	4.599195	2	0.1003
Dlnx	Urbanization rate can not Granger cause per capita net income growth	2.179347	2	0.3363

From Table 4, we can know that in the 5% significant level, per capita net income growth can not cause the urbanization rate of Granger, and urbanization rate can not Granger cause per capita net income growth.

2.5 Impulse Response

The impulse response function is a reflection of influence that the impact of an endogenous variable in the VAR model brings to the other endogenous variables (Figure 2).

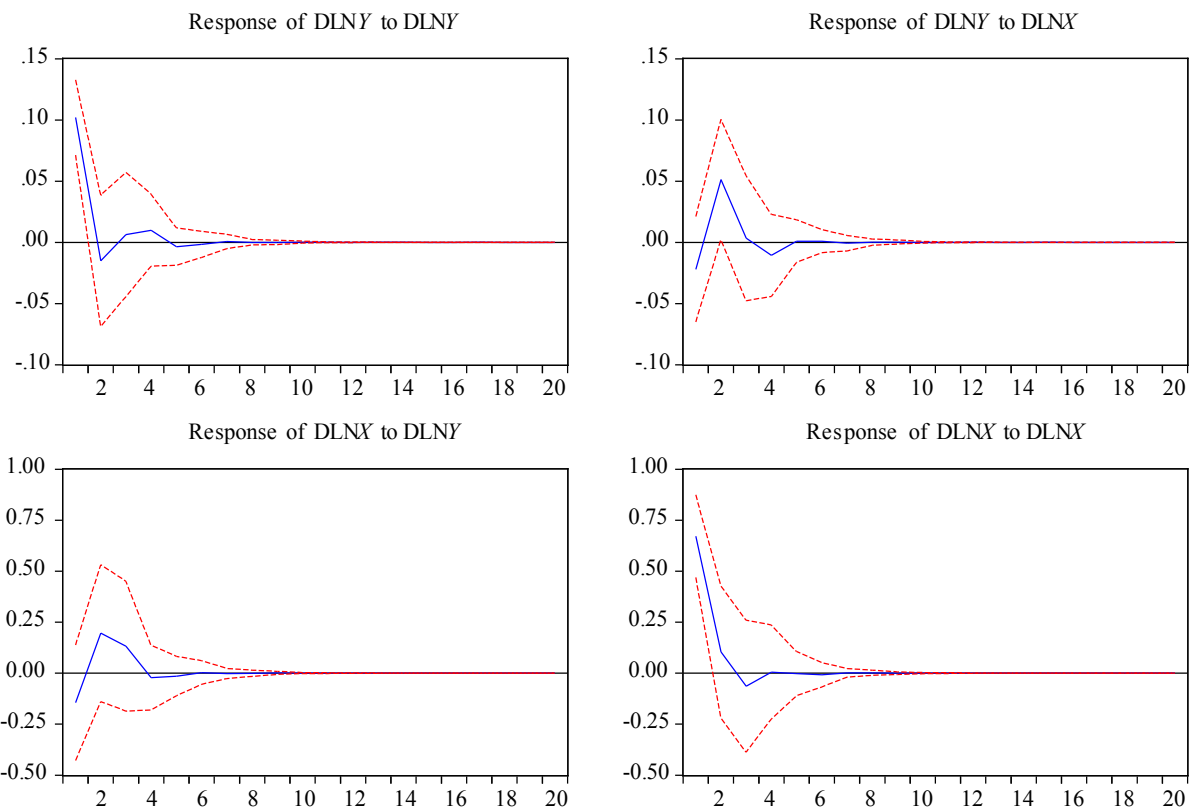


Figure 2
Impulse Response Analysis

Analysis of Figure 2 we know:

(a) The rate of urbanization has a very big impact on itself at first, but the trend suffers a rapid decay, and decays to the lowest point at the second period (-0.015), period 2-7 is slightly fluctuation and the final impact was 0.

(b) When gives a positive impact to the amount of net income per capita in this period, urbanization rate reached the highest point in the first 2 periods after a slight fluctuation in the second period (0.049). That is, the response of the DLn_y to the DLn_x at second periods is 0.049, it decays rapidly from the beginning of the second phase and the final impact is 0.

(c) When gives a positive impact to the urbanization in this period, per capita net income growth fluctuates slightly in the first 2 periods, the impact changes from negative to positive. It reaches the highest point in the second period (0.196). That is, the response of the DLn_y to the DLn_x at second periods is 0.196, and decays rapidly after the second period, but keeps the impact positive and finally to be 0.

(d) Per capita net income growth has a very big impact on itself, but the impact shows a state of rapid decay, reaches the lowest point in the third phase (-0.037). That is, the response of the DLn_y to the DLn_x in third periods is 0.196, and began to slow recovery after third period, the final effect is 0.

2.6 Variance Decomposition

The variance decomposition is to analyze the contribution of each structure impact to the change of the internal variables, and further evaluate the importance of the impact of different structures.

Figure 3 shows that the contribution rate of urbanization and farmers' income to their own development are more than 80%, means that the driving force is the greatest potential for development. The contribution rate of urbanization to farmers' income increased rapidly from first to fourth period, and reached to 15% in the fourth period, after that it has maintained a steady development of the contribution level of 15%; While the contribution rate of the farmers' income to urbanization basically have the same trend, rise rapidly from first to third period, and reached to 19% in the third period, after that it has been to maintain the level of 19% contribution.

The analysis shows that the explanation to oneself is the most convincing, but the contribution rate of urbanization and farmers' income to each other is relatively large. The contribution rate of farmers' income to urbanization is higher than that of urbanization. To a large extent, the increase of farmers' income is the material basis of the development of urbanization, the rapid development of urbanization is an opportunity to raise the income of farmers

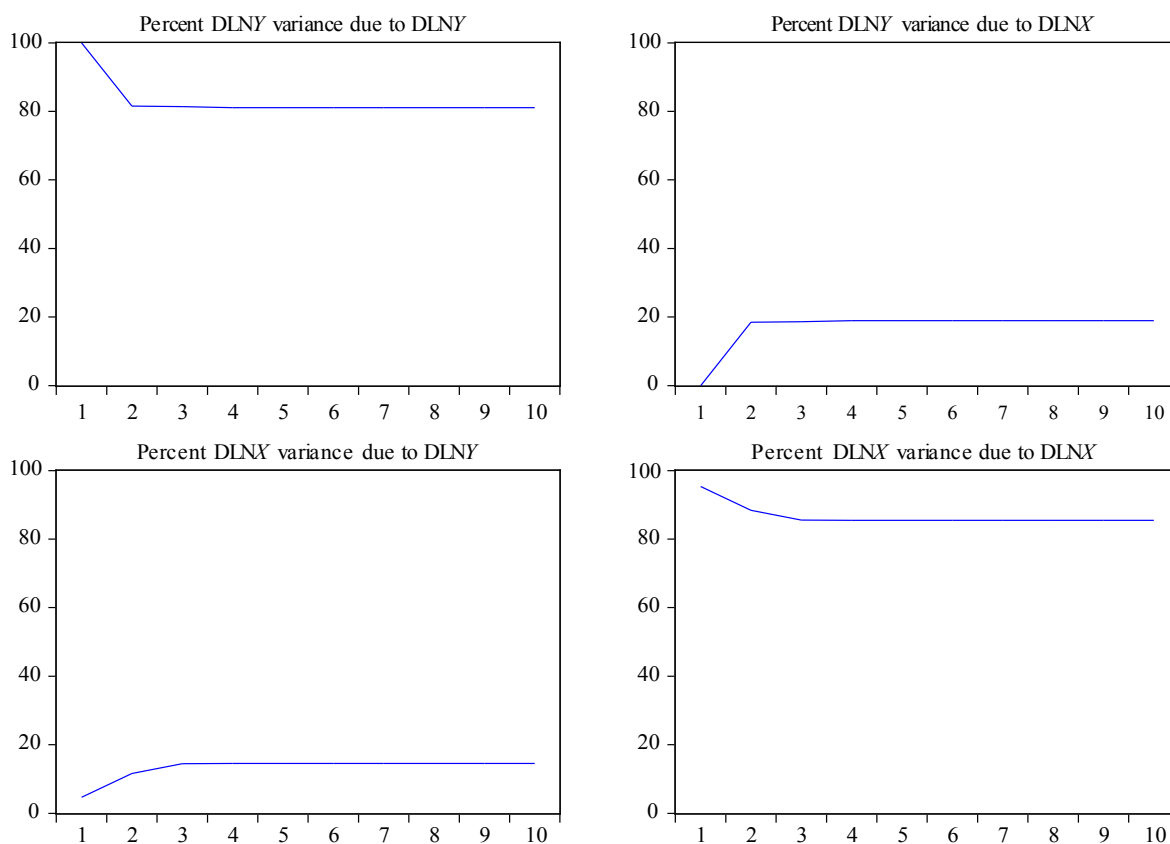


Figure 3
Variance Decomposition Diagram

CONCLUSION

(a) Johansen co-integration test found that the urbanization has a long-term positive equilibrium relationship with farmers' income.

(b) Granger test results show that in the short term, the rate of urbanization and the farmers' income are not the Granger reasons of both, the "reciprocity" of urbanization and farmers' income is not high.

(c) The impulse response function shows that the rate of urbanization and the income of the farmers are restricted to each other, the action and direction are basic the same, the ultimate impact is zero.

(d) The variance decomposition shows that the rate of urbanization and the income of the farmers are mutually supported and promoted, but the self impact is the greatest, so the development of their own is the strongest driving force.

POLICY RECOMMENDATIONS

(a) Adhere to co-ordinate the promotion and strengthen the organization and leadership, take a two handed action on the development of urbanization and raising the income of the farmers to implement, achieve a good interaction with the coordinated development.

(b) Promote the process of urbanization, focus on the people-oriented. Speeding up the reform of the household registration system, and promoting the effective convergence of urban and rural social security system, making more agricultural transfer population become real urban residents. Promoting the transfer of agricultural population to the small and medium-sized cities, enhance

the ability of small and medium-sized urban population. We should vigorously improve the production and living conditions of non-transferred agricultural population, and establish a positive interaction between urban and rural areas.

(c) We must adhere to the government guidance and market promotion, respect for the law of the market, optimize the allocation of resources, broaden the channels on the supply of funds, scientific optimize on land use, increase the supply of energy security, promote the intensive and efficient use of all kinds of factors, clear the two-way interactive channels of urbanization and farmers' income.

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