Quantitative Analysis of Influence of China's Urbanization on its Economy Based on ECM and SVAR Model

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Abstract

At present, the Chinese Government is upgrading its new urbanization to stimulate economic development. What will be the effects of urbanization? Using the Augmented Dickey-Fuller unit root test, the stability of data series of impact factors are tested. According to Granger Causality Tests, the causality between impact factors is confirmed. By means of the method of Error Correct Model and SVAR model, this paper found that there exist causality between urban population and the primary and secondary y i industry, the wholesale and retail trades of the tertiary industry; there is causality between area of built district and the secondary industry, the hotels and catering services of the tertiary industry. However, it was also found that An increase in urban population will lead to increase the demand for the products from the primary industry in the long run, An increase in urban population will result in a small increase in the value-add d of the secondary industry i n the first two years and rapidly decrease to the lowest point i n the fifth year; In the long run, an increase in the value-added of the secondary industry will bring the increase in urban population in seven or eight years.; the expansion of area of built district will lead to an increase in the value-added of hotels and catering services in four years or so; an increase in urban population will arouse a very small fluctuation in the value-added of wholesale and retail trades in seven years and a bigger increase in the next seven or eight years. Hence, if China intends to push a large scale of urbanization forward, suitable city planning such as land-use control, population control, employment, social security and environment protection will be vital for economic development.

Keywords: *New Urbanization; Industry; SVAR model; Error Correct Model; Wholesale and Retail Trades; Hotels and Catering Services*

1. Introduction

Urbanization and economic development go hand-in-hand as a country moves from a rural-agricultural base to an urban-industrial base (Davis & Henderson, 2003). In India, a higher rate of urbanization is related to higher economic growth, lower levels of poverty and greater inequality in urban area (Tripathi, 2013). This is because with the development of science, technology and the economy, the demand rose for public transportation, urban population and education causing an increase in production, environmental protection and natural resources. These demands encouraged the development of industry and urbanization. Therefore, urbanization is the consequence of industry development, especially industrialization. Empirical evidence shows that industrialization and urbanization are important contributory factors to the conversion of farmland. There is an inverse U-shaped relationship between land use intensity and industrialization (Zhang, Mount & Boisvert., 2004). Firms also benefit from industrial diversity, and the strength of such benefit increases with city size but decreases with firm size. (Fu & Hong, 2011). Urbanization effectively creates positive externalities and growth impulses on surrounding areas (Kolomak, 2012). Infrastructure construction, especially advanced transportation, plays a role in sustainable urban development, and a high speed rail can play an important role in providing opportunities for medium and smaller cities through greater connections (Verma, Sudhira, Rathi, King & Dash, 2013). But there are considerable discrepancies between the urbanization process and its infrastructure provision (Batishcheva, 2013). Additionally, foreign aid is associated with urbanization. It enlarges urban areas by means of a

simple theoretical model and empirical work (Sylwester, 2008). However, although many economists view urbanization as an active achievement on the path to wealth and prosperity, there is no empirical evidence of a causal effect of the level of urban population share on the pace of economic growth (Bloom, Canning & Fink, 2008).

According to Levy, there are four main forces behind urban growth: factory production, population growth, increased agriculture and industry productivity, and low-cost transportation (Levy, 2009). However, urban growth needs to be controlled to a certain degree to avoid over development. Therefore, urban planning is very important for economic development and urbanization. It involves land-use controls, space layout, infrastructure, public capital investments (Levy, 2009) and environmental protection such as greenbelt planning, street patter n, transportation network planning, and distribution of industry from political and technical perspectives.

Presently, the Chinese Government is upgrading the new urbanization to stimulate economic development. Then w hat will be the effects of urbanization in China's current economic situation? of agriculture land even food safety. Therefore, in this paper, urban population and area of built district are used to represent the indicators of urbanization.

The indicators of economic development focus on real gross domestic production (real GDP). Real GDP mainly consists of the output of the primary, secondary and tertiary industries. Therefore, in this paper, real GDP, the primary, secondary industry, the service sectors and things like that are used to represent the state of economic development.

In other words, urbanization depends on industry development that simultaneously promotes urbanization. From both the literature and my own analysis, some impact factors such as urban population, area of built district, real GDP, the primary, secondary and tertiary industries, area land, area of land used for urban construction and area of built district, Wholesale and retails Trades, Hotels and Catering services, financial Intermediation, real estate were identified. Then, confirming which factors are related to the impact of urbanization on China's economy using related data from China Statistical Yearbook and China Land and Resources Statistical Yearbook. analyzing which kinds of impact factors are stable and have the characteristic of the same order co integration by means of ADF unit root test, and then, Granger Causality Tests can be used to analyze if there is the causality between the impact factors. The confirmed factors include urban population (up) , area of built district (aobt), the primary industry (piv), the secondary industry (siv), the tertiary industry, arable area (aa) and Hotels and Catering services (hcs). In addition, considering the need of measure and elasticity analysis, the natural logarithm of those

The important indicators that represents China's urbanization and its Economy
An important indicator that represents urbanizain is the ratio of urban population. However, urbanization also leads to the increase of area of built district. At the same time, the increase of area of built district directly results in the decrease of agriculture land eve n food safety. Therefore, in this paper, urban population and area of built district are used to represent the indicators of urbanization.

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are related to the impact of urbanization on China's economy using related data from China Statistical Yearbook and China Land and Resources Statistical Yearbook. analyzing which kinds of impact factors are stable and have the characteristic of the same order co integration by means of ADF unit root test, and then, Granger Causality Tests can be used to analyze if there is the causality between the impact factors. The confirmed factors include urban population (up), area of built district (aobt), the primary industry (piv), the secondary industry (siv), the tertiary industry, arable area (aa) and Hotels and Catering services (hcs). In addition, considering the need of measure and elasticity analysis, the natural logarithm of those indicators are used in this paper.

The natural logarithm of those impact factors are respectively represented in the equation (1).
Ln (impact factor) = log (impact factor)   (1)
The influence of these selected factors on China's economy is demonstrated by the methods of ordinary least square and Error Correcting Model in this paper.

Tests of the Stability of Data Series of Impact Factors and Confirmation of Causality between Them

Because only data series of impact factors are stable and belongs to the same order co integration in econometrics, the causality between them can be analyzed. Therefore, data stability and causality must be tested. By means of ADF unit root test, it is found that the original data series of l nrgdp, lngdppc, lngni and are stable; the impact factors that belong to the first order difference are:lnup, lnpiv, lnsiv, lntiv, lnaobt, lnhcs, lnfi and lnaa ~I(1).

In order to verify if there is a kind of co integration between those factors, granger causality tests associating with the other methods are used in this paper. It is tested that there isn't obvious relationship between urban population and real GDP or GNI because their natural logarithms belong to the original order for data from Chinese Statistical Yearbook. However, for data from Chinese Statistical Yearbook, there are correlations between urban population and the primary industry y, urban population and the secondary industry, urban population and wholesale and retail trades; area of built district and the secondary industry, area of built district and hotels and catering services.

What the Effect of A Change in Urban Population and Area of Built District on China's Economy

The Effect of Urban Population on The Primaryy Industry

Using the method of lag length criteria, it is found that the effectiveness is better when the lag order is selected as 2. There is causality between the primary industryy and urban population and VAR model is stable because no root lies outside the unit circle when VAR stability condition check is made. The response of the primaryindustryy to the change in urban population can be seen in Fig.1.
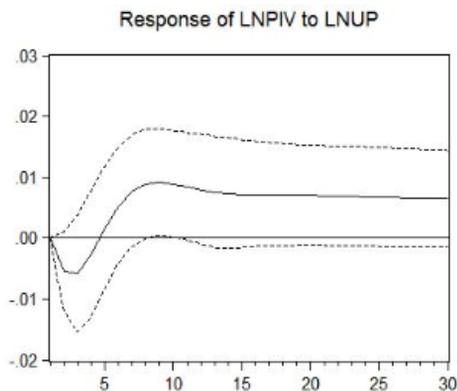

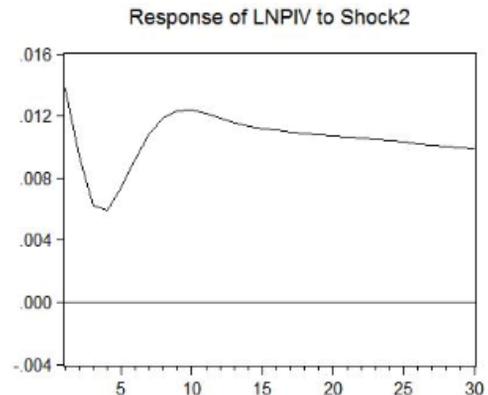Fig. 1 Response of lnpiv to lnup in VAR model   Fig. 2 Response of lnpiv to lnup in SVAR model

In the short run, when a positive impact is exerted to the value-added of the primaryy industryy from urban population, the response of the value-added of the primary industryy will rapidly decrease by 0.583% in the third period, and increase by 0.91% in the ninth period, then become smaller and smaller.

Supposing that the accumulated long-run response of urban population on a shock of the primary industryy equals 0, Structural VAR is established. For SVAR model in Fig.2, a positive shock of urban population will cause the positive impact on the primary industry y in the first period, and then up and down to be gradually stable at a new higher level of the value-added of the primary industry. The response of the value-added of the primary industryy reaches the lowest point, 0.592% in the fourth period and the highest point, 1.37% in the first period.

The results demonstrate that with the development of urbanization, the growth of urban population will lead to the decrease in the value-added of the primary industryy in the short run. However, in the long run, the value-added of the primary industry will be up to a new positive level.

2. The Relationship among Urban Population, Area of Built District and The Secondary Industry y using VAR model with granger causality test and residual test and correlation between urban population and area of built district to analyze if there is an interrelationship among urban population, area of built district and the secondary industryy, it is found that there is very closely reciprocal relationship between urban population and area of built district. Therefore, it is necessary for lnup, lnaobt and lnsiv to separately analyze the relationship between them.

(1) The Impact of Urban Population on the Secondary Industry

Because the regression relationship between urban population and the secondary industry can be analyzed by means of OLS, Assume
$lnsiv = c(1) + c(2)lnup + \xi$

Then, the regression model after adding AR(1) and AR(2) is seen in the equation (3).

$$lnsiv = -18.5762 + 2.6535lnup \qquad\qquad (3)$$
$$t = (-10.8501) \quad (16.6301)$$
$$R^2 = 99.84\% \quad DW = 2.2338$$

The regression model shows that there is a long-term equilibrium between the secondary iindustryy and urban population on account of $R^2 = 99.84\%$, and the value-added of the secondary y industry will increase by 2.65% when urban population rises 1 percent.

ECM model is shown in the equation (4).
$$\Delta(lnsiv) = 0.0773 + 1.7732\Delta(lnup) + 0.2078\Delta(lnup(-1)) - 4.2921\Delta(lnup(-2)) + 1.3614\Delta(lnup(-3)) \qquad (4)$$
$$+ 0.5985\Delta(lnsiv(-1)) + 0.5304\Delta(lnsiv(-2)) - 0.4832\Delta(lnsiv(-3)) - 0.9673ecmupsiv(-1)$$

The ECM model shows that the value-added of the secondary industry y is related to not only urban population in the current and previous three periods, but also its value-added in the previous three periods. It will respectively increase by 1.77%, 0.21%,-4.29% and 1.36% when urban population respectively rises 1% in this period, the previous first period, the previous second period and the previous third period; it will respectively rise 0.6%, 0.53% and -0.48% when its value-added increases 1% in the previous first period, the previous second period and the previous third period. In addition, 96.73% out of the negative deviation between the secondary industry and its long-term equilibrium every year will be corrected.

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In short t, urban population in this period, in the previous first and third period and the value-added of the secondary iindustryy in the previous two period have positive impact on the value-added of the secondary industry y in this period, urban population in the previous second period and the value-added of the secondary industry in the previous third period have negative effect on the value-added of the secondaryy industryin this period. Whether it is in the shortrun or in the long run, the investment for urbanization has a bigger impact on the secondaryy industry.

Using the method of lag length criteria and Johansen Co integration Test, it is found that the order of lags is selected as 3. There is causality between the secondaryindustry and urban population. By VAR stability condition check, VAR model is stable. The response of the secondary industry to the change in urban population is seen in Fig.3. An impact of urban population on the secondaryy industry is weakly positive in the previous two periods, strongly negative in the next three periods, and then is gradually stable at a new level. In the fifth period, the impact of lnup on lnsiv arrives at the lowest point, -1.36%, and in the twelfth period, it arrives at the highest point, 1.15%.
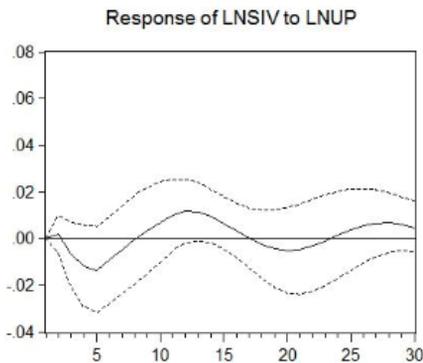

Fig.3 Response of lnsiv to lnup in VAR model   Fig.4 Response of lnsiv to lnup in SVAR model
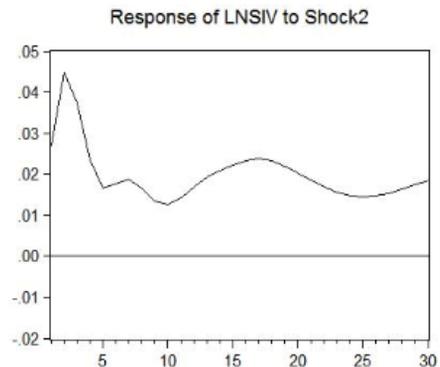
For SVAR model, supposing that the accumulated long-run response of urban population on a shock of the secondary industryy equals 0, S VAR inple response of lnsiv to lnup is show n in Fi g.4. The impact of a positive shock of urban population on the secondary industryy is strongly positive in the first two periods, and then dramatically decreases from the second period to the fifth period. Finally, t he Response of the value-added of the secondaryy industry to it is gradually stable at the new level that is around 1.5% higher than ever. In addition, the effect reaches the highest point, 4.49% in the second period and the lowest point, 1.26% in the tenth period.

It demonstrates that an increase in urban population will result in a smaller increase of the value-added of the secondary i industry y in the first two periods in the short run, and lead to rapid decrease of value-added of the secondary industry in the next three periods. It also show s that the investment for urbanization only flourishes the secondary industry y in the first two years or so, and t hen, the secondary industry y will come into a new higher level than be for e in the long run. What the effect of a shock of the value-added of the secondary industry on urban population? After all, urbanization will promote the development of the secondary industry y by means of the investment in capital and technology.

The response of urban population to the change in the secondary industry in VAR model is seen in Fig.5. A positive impact of the secondary industry on urban population is positive in the previous eight periods, and then is gradually stable at a new level that is about 0.5% higher than ever. In the eighth period, the impact of the secondary industry y on urban population arrives at the highest point, 1.12%. It indicates that the investment for urbanization will give rise to increase in the value-added of the secondary industry

which causes the growth of urban population in the short term because the secondary y industry provides some new job opportunities to the people.
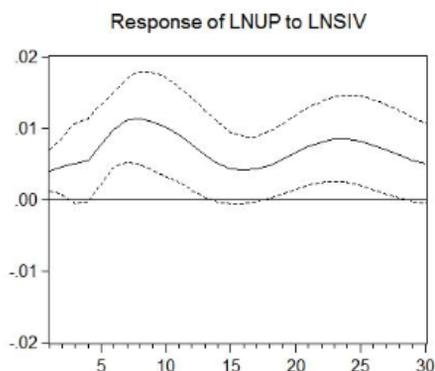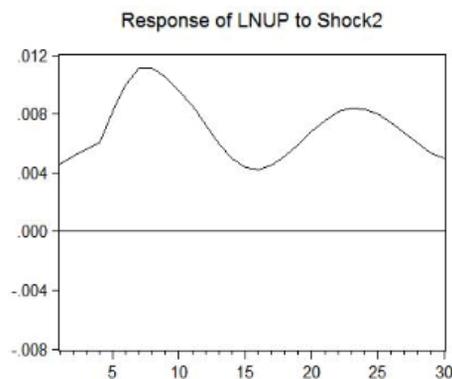

Fig.5 Response of lnup to lnsiv in VAR

Fig.6 Response of lnup to lnsiv in Structural VAR for SVAR

Model in Fig.6, assume that the accumulated long-run response of the Secondary industryy on a shock of urban population equals 0. A positive shock of the secondary i industry y will result in strongly positive impact on urban population in the first seven periods, strongly negative from the seventh period to the sixteenth period, and then, the response of urban population is gradually stable at the new level that is around 0.4% higher than ever. I n addition, the effect reaches the highest point, 4.49% in the seventh period. It illustrates that in the long term, urbanization will bring about an increase in the value-added of the secondary industry y which brings an increase in urban population. However, the change i n its increase is very smaller. The results show that the secondary y industry provides less new employment opportunity based on the present iindustryy structure

(2) The Effect of Area of Built District on the Secondary Industryy

The regression model between area of built district and the secondary iindustryy is seen as the following equation (6) after adding AR(1)

$$\text{lnsiv} = -9.61123 + 1.93358\text{lnaobt} \qquad (6)$$
$$t = (-18.8998) \quad (37.9735)$$
$$R^2 = 99.77\% \quad DW = 1.9614$$

As seen in equation (6), the value-added of the secondaryy industry will increase by 1.93% when the area of built district rises 1%. Therefore, there is long-term relationship between the secondary iindustryy and area of built district

ECM model is:
$$\Delta(\text{lnsiv}) = 0.0458 + 0.62895\Delta(\text{lnsiv}(-1)) + 0.5178\Delta(\text{lnaobt}) - 0.5639\Delta(\text{lnaobt}(-1)) - 0.5368\text{ecmsiva}(-1) \qquad (7)$$

ECM model shows that the value-added of the secondary iindustryy will respectively increase by 0.63%, 0.52% and -0.56% when the value-added of the secondary iindustryy rises 1% in last period and area of built district rises 1% in this period and last period. In addition, -53.68% out of the negative deviation between value-added of the secondary y industry and its long-term equilibrium ever y year will be corrected.

Then, consider VAR model. Using length criteria and Johansen Co integration Test, the lag order is selected as 3 and there is co integration between the secondary industryy and area of built district.

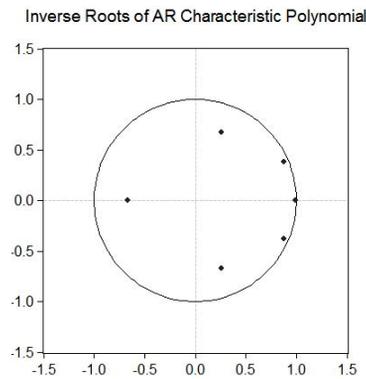Inverse Roots of AR Characteristic Polynomial

Fig.3 the stability check of VAR model

According to VAR stability condition check in figure 3.3, no root lies outside the unit circle, VAR model between area of built district and the secondaryy industry is stable.

In VAR model, the response of the secondary iindustryy to the change in area of built district is shown in Fig.7. The impact of a change in area of built district on the secondary industry is positive and reaches the highest point, 4.8% in the seventh period. It demonstrates that the expansion of area of built district will result in a bigger increase in the value-added of the secondary industryy in the short run.

Assuming that the accumulated long-run response of area of built district on a shock of the secondary industry equals 0, the response of lnsiv to lnaobt in SVAR is seen in Fig.8. A positive shock of area of built district will result in strongly positive impact on the value-added of the secondaryy industryy and the effect is gradually stable at the new level that is higher than ever. In addition, the effect reaches the highest point, 4.787% in the seventh period. It illustrates that in the long run, urban construction will bring about the increase in the value-added of the secondary industryy
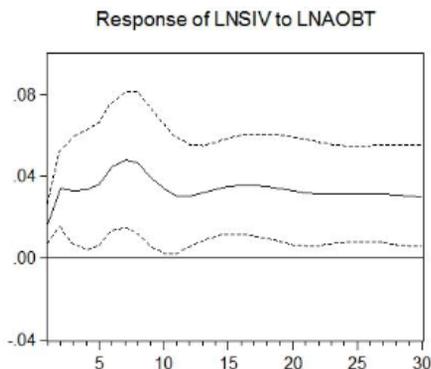
Response of LNSIV to LNAOBT

Response of LNSIV to Shock2
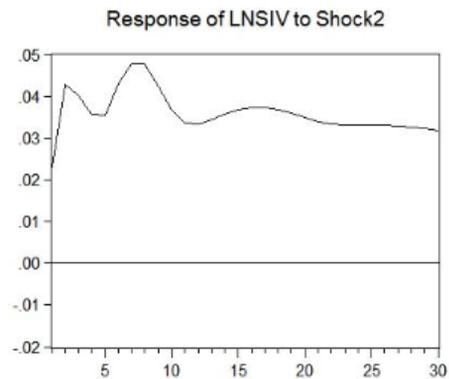
Fig.7 Response of lnsiv to lnaobt in VAR   Fig.8 Response of lnsiv to lnaobt in Structural VAR

In a word, whether in the short run or long run, the expansion of area of built district will cause a bigger increase in value-added of the secondary industry in seven years.

3. The Effect of Urban Population and Area of Built District on The Tertiary Industryy

The tertiary industryy includes wholesale and retail trades, hotels and catering services, financial inter mediation and real estate. According to the methods of granger causality test, there isn't obvious serial correlation between area of built district and total value-added of the tertiary industryy after testing by means of causality test methods, however, there is co integration relationship between area of built district and hotel and catering services, urban population and wholesale and retail trades.

(1) The Effect of Area of Built District on Hotels and Catering Services

The OLS method after adding AR(1) is

$$\text{lnhcs} = -12.50541 + 1.86996\text{lnaobt} \qquad (8)$$
$$t = (-47.0129) \quad (69.61367)$$
$$R^2 = 99.71\% \quad DW = 1.7329$$

As seen in equation (8), dl= 1.352, du= 1.489, therefore, there is a long-term equilibrium between area of built district and hotels and catering services. The residual serial is stable because ADF test on residual serial is passed.

The regression model shows that there is very closely long-term relationship between area of built district and hotels and caterng services on account of

$R^2 = 99.71\%$, and the value-added of hotels and catering services will increase by 1.87% when area of built district rise 1 percent

ECM model is

$$\Delta(\text{lnhcs}) = 0.0726 + 0.6565\Delta(\text{lnaobt}) - 0.692\text{lecmahcs}(-1) \qquad (9)$$

The ECM model showss that the value-added of hotels and catering services will rise 0.66% when area of built district rise 1%. What's more, 69.21% out of the negative deviation between the value-added of hotels and catering services and i ts

long-term equilibrium every year will be corrected. It shows that urbanization construction will promote the development of hotels and catering services.

In order to find out the response of lnhcs to lnaobt in the short run and long run, VAR and SVAR need to be established. It is tested that the order of lags is selected as

1. The impulse response of lnhcs to lnaobt in VAR model is demonstrated in Fig.9. When area of built district exerts a positive impulse on hotels and catering services, the positive impact will come out and arrive at the highest point, 3.53% in the fourth period, and then decrease
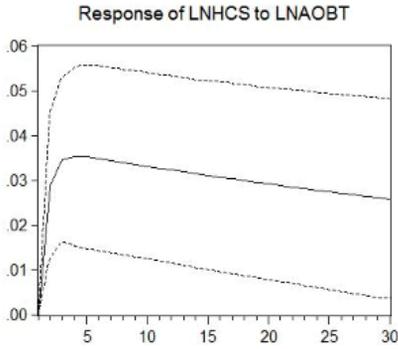
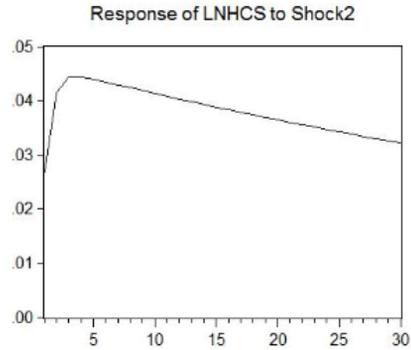Fig.9 Response of lnhcs to lnaobt in VAR   Fig.10 Response of lnhcs to lnaobt in Structural VAR

Suppose that the accumulated long-run response of area of built district on a shock of hotels and catering services equals 0. For the impulse response in SVAR model in Fig.10, when area of built district give a positive shock to the value-added of hotels and catering services, the effect will be positive and reaches the highest point, 4.44% in the fourth period and then descend.

It demonstrates, short-term or long-run, that an expansion in area of built district, namely urbanization construction, will cause a dramatic increase of the value-added of hotels and catering services in the first four periods and then rapid decrease. It shows that the investment for urbanization only flourishes the hotels and catering services in the first four years or so, and then, there is rapidly decrease. Therefore, after four years or so, some people who engaged in hotels and catering services will lose their jobs.

(2) The Effect of Urban Population on Wholesale and Retail Trades

Because there is causality between urban population and wholesale and retail trades when the lag order is selected as 3 and VAR model is found to be stable using the method of VAR model stability condition check. Then, there exists VAR model between lnup and lnwrt

On the assumption that the accumulated long-run response of area of urban population on a shock of wholesale and retail trades equals 0, SVAR impulse response of lnwrt to lnup is shown in Fig.12
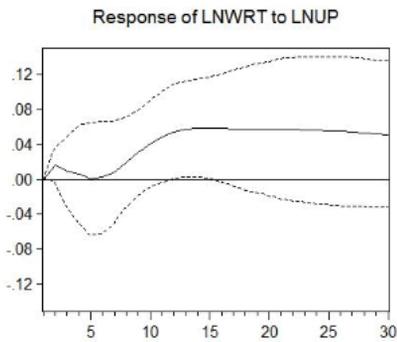

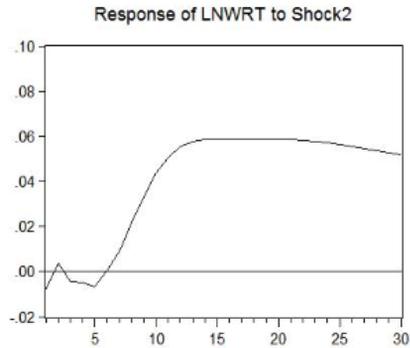Fig.11 Response of lnwrt to lnup in VAR   Fig.12 Response of lnwrt to lnup in Structural VAR

In Fig.11 and Fig.12, whether the impact of urban population on wholesale and retail trades is in the short run or long run, an increase in urban population has a smaller effect on the wholesale and retail trades in the previous seven years. However, after seven years, the value-added of wholesale and retail trades will have a bigger increase and reaches the highest value in the fifteenth years, then fall but maintain the positive impact. The results indicate that there is 7 years' lag from investing in wholesale and retail trades and getting the profit from the operating wholesale and retail trades and there is prosperity period (about 8 years). After that, the wholesale and retail trades will come into a saturation state, the shrink

3. Conclusion

By making analysis for the related data of China Statistical Yearbook, C hi na Land and Resources Statistical Yearbook from 1981 to 2011, it is found that there exist causality between urban population and the primary and secondary industry, the wholesale and retail trades of the tertiary industry, there is causality between area of built district and the secondary industry, the hotels and catering services of the tertiary industry; the value-added of the primary industry decreases to the lowest in the third years and up to the highest in the ninth or tenth years with an increase in urban population; the value-added of the secondary industry will have a small increase in the previous two years and a rapid decrease from the second year to the fifth year with a positive shock of urban population, an increase in the value-added of the secondary industry will bring the increase in urban population in seven or eight years; in the short run or long run, the expansion of area of built district will also cause a bigger increase in the value-added of the secondary industry in seven years; the expansion of area of built district will lead to increase in the value-added of hotels and catering services in four years or so; an increase in urban population will result in a very small fluctuation in seven years and a bigger increase in the next seven or eight years in the value-added of wholesale and retail trades.

Just as the researchers mentioned, decreases in the share of agricultural value added lead to a significant increase in the urbanization rate; changes in the value-added of agriculture does not significantly affect the urbanization rate (Brückner, 2012).

For the current China, if the scale of urbanization is too large, after four years or so, there are some problems come out such as land-use control, high unemployment, overcrowded cities, food safety and society security. furthermore, the investment for urbanization only bring economic boo m in eight years. However, wholesale and retail trades have seven or eight years' prosperity after seven years' accumulation stages. Overall, the quantitative result shows that the influence of China's urbanization on its economy is restricted to a certain degree in the present economic situation. Hence, it is vital for China' economic development to formulate and carry out the suitable city planning such as land-use control, population control, employment, social security and environment protection will be vital for economic development.

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