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Quantitative Analysis of Interaction among Employment in China's Urban Area, Urbanization and Economic Development

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Abstract: In this study, by means of VAR and SVAR model with long-run restriction, we study the interaction among urban employment in China, urbanization and economic development to analyze the rationality of China's new urbanization. The results shows that for China, an increase of urban employment brings about a strongly positive impact on the secondary and tertiary industry in the previous four or five years; the impact of an increase in the value-added of the secondary and tertiary industry on urban employment is positive in the first year and decreases in the next two or three years and finally reaches a new positive level; an increase in the number of employed persons in the urban area greatly raises the dem and for energy consumption in seven years. Therefore, the Chinese Government should work out and roll out its new policies and measures to stimulate China's economy in these key time points and according to the priorities of the secondary and tertiary industry, simultaneously protect and explore energy and related high technology to avoid energy depletion.

Key words: New urbanization, employment in the urban area, svar model, industry, total energy consumption

INTRODUCTION

The research result shows that economic development is positively related to population density (Murova and Rainey, 2002). Asia's share of urban population has increased from 40-46.2% in the last two decades (Asian Development Bank, 2012). Empirical studies indicate that from one-third to half of urban population growth is the direct result of immigration from rural areas (United Nations, 1998), often resulting in high levels of unemployment (Gaude and Peek, 1976). Accordingly, one of the major problems related to urban development is how these areas cope with the problem of urban unemployment (Gugushvili, 2006). That is to say, how to improve the growth of urban employment is vital for urban development. Employment growth is enhanced by industrial diversity and local competition but retarded by industrial specialization (Van Soest *et al.*, 2002).

Daniela HÎNCU uses markov chain analysis to evaluate the convergence trends in the employed population in Romanian urban areas. The result shows that employment in agriculture, forestry and fishing will gradually increase and reach 30.09% in 2010 and the number of employed persons in secondary industries will gradually decrease; employed population in trade and service will gradually increase for this selected area (Hincu, 2011). In Jakarta, the manufacturing sector

decreased by 25% from 1960-1961 and the trade and service sectors created many employment opportunities for the urban population (Sethuraman, 1976). Urban employment is associated with the range of goods and services, the wage structure and the criteria for entry and success (Kannappan, 1985). In addition, social networks facilitate self-employment in urban China (Yueh, 2009). 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 *et al.*, 2008). Some researchers examined two specific issues related to population employment growth models, namely the weight matrix and the performance of the lagged adjustment model to demonstrate the selection of the variables. The nature of the contemporaneous interaction between population and employment growth was sensitive to the specification of the weight matrix (Boarnet *et al.*, 2005). A big part of the growth in employment came from the process of fast-growing districts (Levy, 2009).

Of course, every country has its own history of economic development. At present, the Chinese Government is promoting the process of the new urbanization to stimulate economic development that keep the real GDP growth by driving the development of the secondary and tertiary industry and improve the growth

rate of urban employment. After all, an important indicator that represents urbanization is the ratio of urban population, thus urban employment is very important for urban development. In addition, it is vital for one country's sustainable development to decrease total energy consumption. Therefore, the interaction among urban employment and the secondary and tertiary industry, total energy consumption is analyzed to find out the relationship among urban employment, urbanization and economic development in this study.

Their interrelationship is analyzed by means of related data and all kinds of statistical methods. Based on data analysis of the main and of China from China Statistical Yearbook from 1981-2012 (NBSC, 2012), the stability of data series of impact factors is tested by using augmented Dickey-Fuller unit root test. The method of Granger Causality Tests is used to confirm the causality between impact factors. The statistical outcome shows that the influence of urban employment on China's economy and urbanization is mainly reflected by the relationship between the impact factors of the number of employed persons in the urban area (pue) and the value-added of the tertiary industry (tiv), the value-added of the secondary industry (siv) and total energy consumption (tec) after some economic factors are removed from the analysis because there are no obvious relationship between them. By means of method of Ordinary Least Squares, a VAR and SVAR model, what are the interactions between pue, tiv, siv and tec is explored.

The value-added of the tertiary and secondary industry are calculated based on the relevant indices and constant 1981 price. However, considering economic meaning of these variables, all variables are used in the form of the natural logarithm of variables. The natural logarithm of the impact factors are calculated, respectively in the Eq. 1:

$$\ln(\text{impactfactor}) = \log(\text{impactfactor}) \quad (1)$$

Therefore, ln pue, ln tiv, ln siv and ln tec are used in this study.

GLOSSARY OF SPECIFIC TERMS

The value-added of the tertiary industry refers to value added in wholesale and retail trade, transport and government, financial, professional and personal services such as education, health care and real estate services (World Bank).

The number of employed persons in the urban area from China Statistical Yearbook that is referred to as urban employment in this study refers to the sum of persons aged 16 and over who are engaged in gainful employment and thus receive remuneration payment or earn business income in the urban area.

The value-added of the secondary industry from China Statistical Yearbook refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas and construction.

Total energy consumption from China Statistical Yearbook refers to the total consumption of energy of various kinds by the production sectors and the households in the country in a given period of time. It includes that of coal, crude oil and their products, natural gas and electricity. However, it does not include the consumption of fuel of low calorific value, bio-energy and solar energy.

RECIPROCAL RELATIONSHIP AMONG EMPLOYMENT IN CHINA'S URBAN AREA, URBANIZATION AND ITS ECONOMIC DEVELOPMENT

The stability of impact factors like ln pue, ln tiv, ln siv and ln tec needs to be tested because only the impact factors that are stable can be used to analyze causality among them. In this study, the method of Augmented Dickey-Fuller (ADF) unit root test is used to test the stability of data series of impact factors. It is found that these impact factors belong to the first order difference at 5% significance level.

For the impact factors that have the same order, the method of Granger Causality Tests or Johansen Cointegration Tests is used to analyze the causality between them. The result shows that there is reciprocal causality between ln tiv and ln pue; there is reciprocal causality between ln siv and ln pue; there is causality between ln tec and ln pue. Therefore, the regression relationship between ln pue and ln tiv, ln siv and ln tec is analyzed by VAR and SVAR model.

Interaction between urban employment and the tertiary industry: Because there exists mutual causality between ln pue and ln tiv as mentioned above, VAR model is applied to analyze the interaction between them.

Using VAR Lag Order Selection Criteria, it is found that the effectiveness is the best when the lag order is selected as 2. VAR Model is shown in the Eq. 2 and 3:

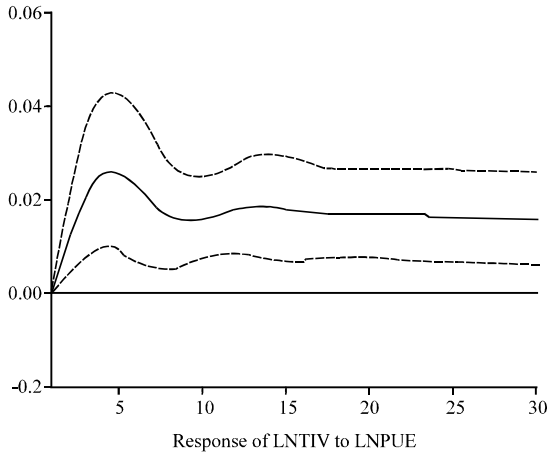


Fig. 1: Response of Lntiv to lnpuue in VAR model

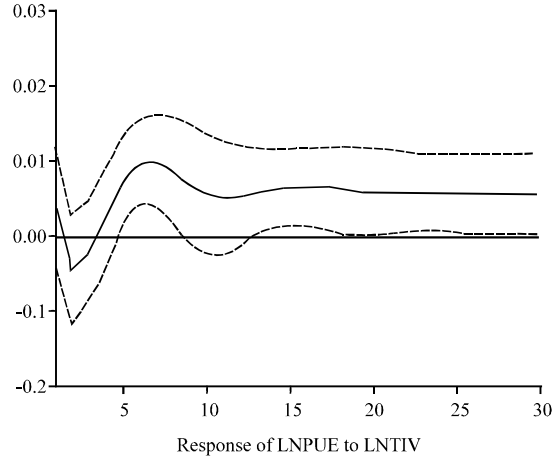


Fig. 3: Response of lnpuue to Lntiv in VAR model

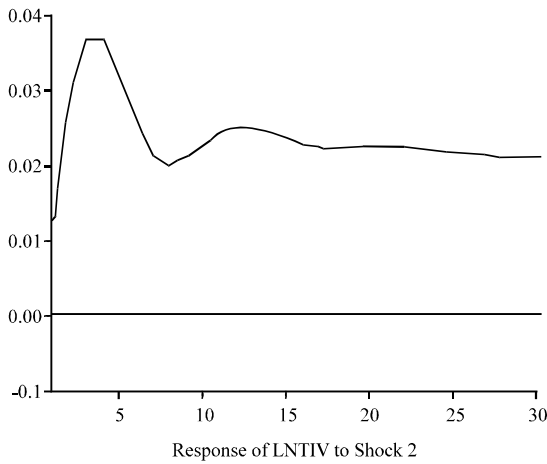


Fig. 2: Response of Lntiv to Lnpue in SVAR model

$$\begin{aligned} \text{Lntiv} = & 1.5663\text{Lntiv}(-1) - 0.7502\text{Lntiv}(-2) \\ & + 0.5141\text{lnpuue}(-1) - 0.0551\text{lnpuue}(-2) - 2.9325 \end{aligned} \quad (2)$$

$$\begin{aligned} \text{lnpuue} = & -0.3046\text{Lntiv}(-1) + 0.4489\text{Lntiv}(-2) \\ & + 0.39098\text{lnpuue}(-1) + 0.2305\text{lnpuue}(-2) + 2.5989 \end{aligned} \quad (3)$$

By means of VAR stability condition check, the result indicates that no root lies outside the unit circle. Therefore, the VAR model is stable. There is interaction between urban employment and the tertiary industry.

Impulse response is as follows.

As shown in Fig. 1, an impact of urban employment on the tertiary industry is strong positive in the previous five years and declines in the next four years, then is gradually stable at a new higher positive level. In the fifth year, the impact of lnpuue on Lntiv arrives at the highest point, 2.582% and in the ninth year, it arrives at the lowest point, 1.536%.

Assuming that the accumulated long-run response of urban employment on a shock of the tertiary industry equals 0, impulse response of Lntiv to lnpuue in SVAR model is shown in Fig. 2.

A shock of urban employment on the tertiary industry will lead to rapidly increase in the value-added of the tertiary industry in the previous four years and rapidly decrease in the next four years, then arrive at its new level that is about 2% higher than before. The highest point is 3.71% in the fourth year and the lowest point is 1.997% in the eighth year. It indicates that a change in urban employment will have big positive effect on the tertiary industry in four years and then the value-added of the tertiary industry will maintain the new increased level.

Then what the effect of the tertiary industry on the number of employed persons in the urban area?

The response of lnpuue to Lntiv in VAR model is seen in the Fig. 3.

When the value-added of the tertiary industry gives a positive shock to urban employment, the number of employed persons in the urban area will rapidly rise by 0.38% in the first year and decrease by 0.43% in the second year, then dramatically increase by 1.003% in the seventh year, gradually decrease to its new higher positive level than before.

Supposing that the accumulated long-run response of the tertiary industry on a shock of urban employment equals 0, SVAR impulse response of lnpuue to Lntiv is shown in Fig. 4.

A positive shock of the tertiary industry on urban employment will rapidly increase by 1.82% in the first year and dramatically decrease by 0.22% in the third year, then gradually reach a new higher positive level of urban employment. It indicates that if the investment for urbanization promotes the tertiary industry, accordingly,

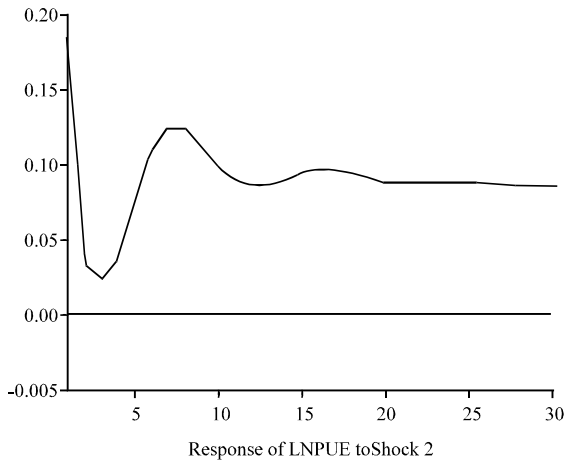


Fig. 4: Response of lnPUE to lnTIV in SVAR model

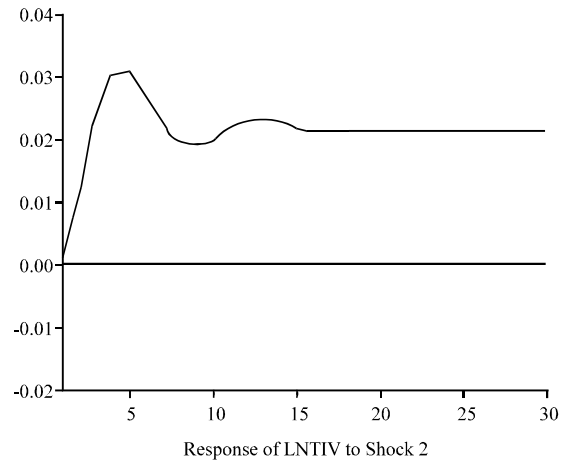


Fig. 6: Response of lnSIV to lnPUE in SVAR Model

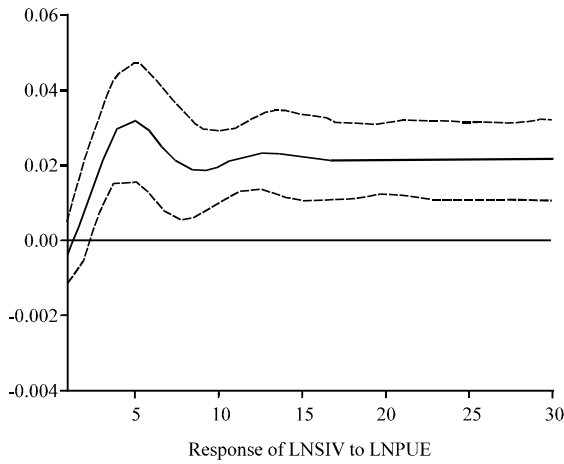


Fig. 5: Response of lnSIV to lnPUE in VAR Model

it will result in an increase in the number of employed persons in the urban area in the first year and decrease in the next two years, then drive urban employment to the higher level than ever.

Interaction between urban employment and the secondary industry: Because there is mutual causality between lnPUE and lnSIV, a VAR model is applied to analyze the extent of the interplay between them.

Next, using VAR Lag length Criteria, the lag order is determined as 2. VAR Model is shown in the Eq. 4 and 5:

$$\begin{aligned} \ln PUE = & 0.51329 \ln PUE(-1) + 0.39909 \ln PUE(-2) \\ & - 0.38458 \ln SIV(-1) + 0.41347 \ln SIV(-2) + 0.69743 \end{aligned} \quad (4)$$

$$\begin{aligned} \ln SIV = & 0.46262 \ln PUE(-1) + 0.22684 \ln PUE(-2) \\ & + 1.19779 \ln SIV(-1) - 0.44332 \ln SIV(-2) - 4.44528 \end{aligned} \quad (5)$$

According to VAR stability condition check, all inverse roots of characteristic polynomial fall within the unit circle. This implies that the VAR model is stable. There exists the interaction between urban employment and the secondary industry.

Impulse response of lnSIV to lnPUE is as follows in Fig. 5.

For VAR model, when a positive impact from urban employment is exerted on the secondary industry, the fluctuation in the value-added of the secondary industry is rapidly up to the highest point, 3.1709% in the fifth year and down to the lowest point, 1.8196% in the ninth year. Then there is a fluctuation within a narrow range and finally, it comes to a new higher positive level of the secondary industry.

Consider SVAR model. On the supposition that the accumulated long-run response of urban employment on a shock of the secondary industry equals 0, SVAR model is established under the long-run restriction. The impulse response in SVAR model is shown in Fig. 6.

For SVAR model in Fig.6, a shock of urban employment on the secondary industry will lead to positive impact in the previous five years and decrease to a new positive level of value-added of the secondary industry. The highest point is 3.1% in the fifth year and the lowest point is 1.87% in the ninth year. It indicates that a change in urban employment will have a great positive impact on the secondary industry in five years.

What the effect of the secondary industry on the number of employed persons in the urban area?

The response of lnPUE to lnSIV is shown in Fig. 7.

For VAR model, when a positive impact from the secondary industry is exerted to urban employment, the number of employed persons in the urban area decreases

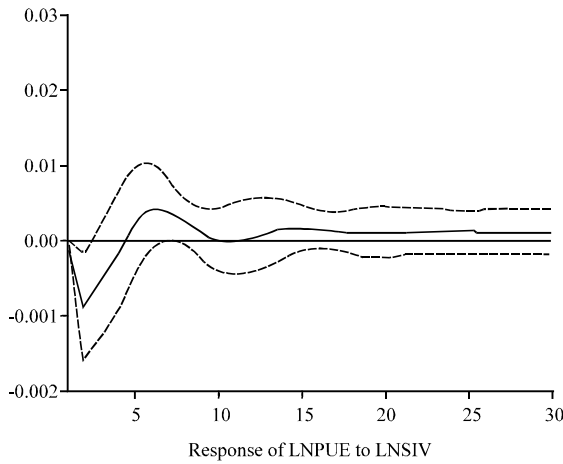


Fig. 7: Response of lnpu to lnsv in VAR Model

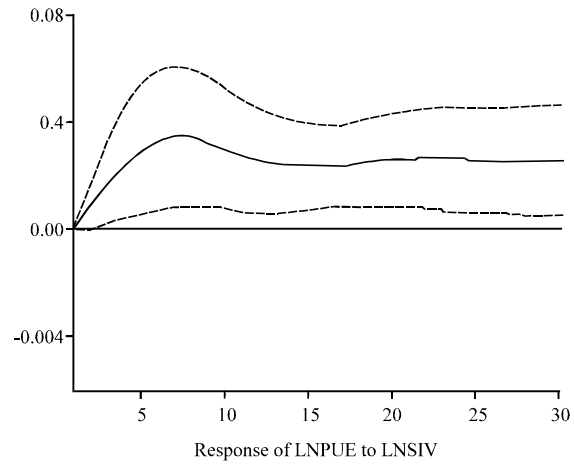


Fig. 9: Response of lnec to lnpu in VAR model

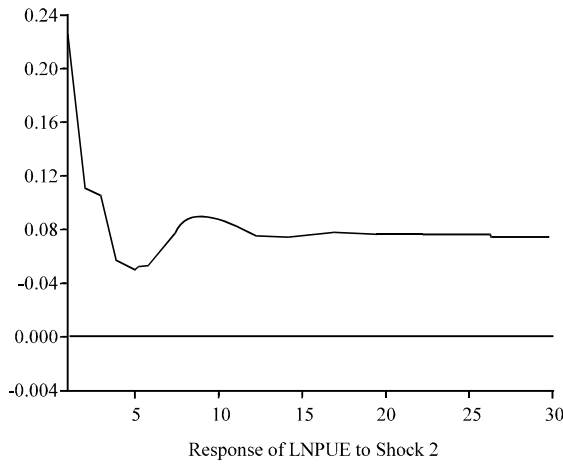


Fig. 8: Response of lnpu to lnsv in SVAR model

in the previous four years and then begins to ascend to a new positive level although the increase in urban population is very small. and it reaches the lowest point, -0.9067% in the second year and the highest point, 0.4157% in the sixth year.

On the supposition that the accumulated long-run response of the secondary industry on a shock of urban employment equals 0, SVAR model is established under the long-run restriction. The impulse response in SVAR model is shown in Fig. 8.

When the secondary industry gives a positive shock to urban employment, it is found that the number of employed persons in the urban area has a big increase in the first year and then become smaller and smaller. The effect reaches the highest point, 2.21% in the first year.

It means that in the long term, the impact of the secondary industry on the number of employed persons in the urban area is positive but it is smaller.

In short, what the investment for the secondary industry can bring is less employment opportunities whether in the short run or long run.

Effect of urban employment on total energy consumption: Because there exists causality between lnpu and lnec, VAR and SVAR model with long-run restriction is used to analyze the relationship between them.

Using VAR Lag Order Selection Criteria, it is tested that the effectiveness is the best when the lag order is selected as 2. VAR Model is shown in the Eq. 6:

$$\begin{aligned} \ln ec = & 1.6747 \ln ec(-1) - 0.8072 \ln ec(-2) \\ & + 0.2989 \ln pu(-1) - 0.1104 \ln pu(-2) - 0.2931 \end{aligned} \quad (6)$$

By means of VAR stability condition check, the result shows that no root lies outside the unit circle. Therefore, the VAR model in Eq. 6 is stable. There is causality between the number of employed persons in the urban area and total energy consumption.

For VAR model in Fig. 9, when a positive impact from urban employment is exerted on total energy consumption, total energy consumption rapidly increase to the highest point, 3.45% in the seventh year and gradually decrease and is stable at its new higher level than before.

What's more, assuming that the accumulated long-run response of urban employment on a shock of total energy consumption equals 0, the impulse response is shown in Fig. 10.

For SVAR, a positive shock of urban employment will lead to a strongly positive impact on total energy consumption in the previous five years and the impact will reach the highest point, 4.28% in the fifth year, then,

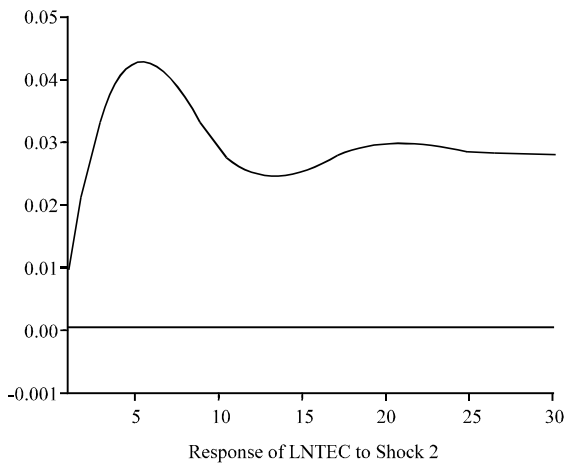


Fig. 10: Response of Intec to lnpu in SVAR model

gradually fall and is stable at a new positive level of total energy consumption. It shows that a change in urban employment will have a great positive impact on total energy consumption in five years. In a word, urban employment will cause the bigger increase on total energy consumption.

EFFECTS AMONG URBAN EMPLOYMENT IN CHINA AND A LARGE SCALE OF URBANIZATION

For China, the increase of the number of employed persons in the urban area sources from the need of industry development and the growth of urban population. China's urbanization means that more and more funds are invested in related industry and fields and more and more urban population will be brought to the urban area.

The expansion of the secondary and the tertiary industry will recruit new employees. Therefore, they will cause an increase in the number of employed persons in the urban area in the first year and rapidly decrease in the next two years, then up to a new positive level. In addition, the effect of a positive change in the value-added of the tertiary and secondary industry on urban employment is positive in the long run. However, the effect of the tertiary industry is bigger than that of the secondary industry. Accordingly, an increase in the number of employed persons in the urban area will result in rapid increase in the value-added of the tertiary and secondary industry in the previous four or five years. and then, the effect will gradually become smaller and smaller. In addition, urbanization also greatly raises the demand for energy consumption in seven years. Therefore, after

four or five years, a large scale of urbanization will trigger many problems such as housing problems, high unemployment, social security, public service, health care, energy depletion, rapid decrease of arable land, food safety and education and so forth. Consequently, it is necessary for China's economic development to work out urban planning, strategy planning of energy conservation and capital allocation in different industry before economic policies are implemented and capital is invested.

CONCLUSION

The empirical researches show that for China, there exists reciprocal causal relationship between urban employment and the tertiary industry, the secondary industry and total energy consumption by the method of Granger Causality Tests, Johansen Cointegration Tests, etc. A positive change in the secondary and tertiary industry results in the positive change in the number of employed persons in the urban area in the first year and change in the opposite direction in the next two or three years and finally a small positive change. A positive shock of the number of employed persons in the urban area brings positive change in the secondary and tertiary industry in four or five years and in the long run, the secondary and tertiary industry will be stable at a new positive level than ever. What's more, an increase in the number of employed persons in China's urban area also greatly raises the demand for energy consumption in seven years. Therefore, The Chinese government rolls out policies and measures to further stimulate China's economic development in these key time points and according to the priorities of the secondary and tertiary industry, simultaneously protect and explore energy and related high technology to avoid energy depletion. China's urbanization should also pay more attention to make urban planning especially funds allocation between the secondary and tertiary industry and also energy-use protection planning.

However, because China's urbanization may only bring an increase in the value-added of the secondary and tertiary industry that make all walks of life flourish in the four or five years, the large scale of urbanization is only suitable for a specific period of economic development. This implies that a large scale of urbanization may give rise to strongly negative results in the future such as housing problems, social security, public service, high unemployment, crime, health care, rapid decrease of arable land, grains and education and so forth. Therefore, if a country wants to carry on a large scale of urbanization, the government must formulate urban planning.

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