

Empirical Research on the Relationship between Urbanization Process and Urban-Rural Income Gap in China

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Keywords: Urbanization; urban-rural income gap; var model; impulse response

Abstract: Based on the vector autoregression model, using the time series data from 1997 to 2018, using the pulse response function and prediction variance decomposition method analyzes the dynamic relationship between the urbanization development and urban and rural income gap, the results show that the development of urbanization in the expansion of urban and rural income gap has a strong effect, and the long-term positive impact will be more significant. In the short term, the development of urbanization has a small positive impact on the expansion of the urban-rural income gap, but in the long run, the development of urbanization will cause the continuous positive increase of the urban-rural income gap. In a long time, the development of urbanization is an important reason for the widening of the urban-rural income gap. In general, the impact of the widening urban-rural income gap has had very little impact on urbanization. Through the var model, the policies and measures to guide and support foreign investment in rural areas are proposed to accelerate the narrowing of the urban and rural income gap and maintain social harmony and stability.

1. Introduction

Since the reform and opening up, China's rapid economic development, economic structure optimization, made remarkable results, the GDP also from 364.52 billion yuan in 1978 to 900309 billion yuan, up nearly 247 times in 2018, per capita GDP also rose from 381 yuan to 67451 yuan, up nearly 177 times, but there is no denying that as China's economic growth growth, urban and rural income gap continues to expand, this is China's economic development cannot ignore must face the problem. China's urbanization rate rose from 29,9 percent in 1997 to 59.58 percent in 2018. During the same period, China's urban per capita income also rose from 5,160.3 yuan in 1997 to 39,251 yuan in 2018, and from 2,090.1 yuan to 14,617 yuan. The annual per capita disposable income of urban residents increased by 7.6 times to 7 times higher than in 1997, but the basic number of urban residents was much larger than the rural population. It can be seen that under the background of urbanization, the absolute income of urban and rural areas increased significantly, but the income gap has not narrowed, due to different income sources, the benefit distribution in the process of urbanization, these factors lead to the income growth between urban and rural residents, but the income gap between urban and rural residents, it shows that the distribution of urban and

rural residents has obvious imbalance, which will lead to new contradictions and economic development imbalance in the new period.^{[1][2][3]}Therefore, the relationship between urbanization and urban and rural income gap is discussed, and the rationalization suggestions of narrowing the urban-rural income gap under the trend of urbanization have some practical significance for coordinating urban and rural development.

From the perspective of the relationship between urbanization and urban and rural income. Yan Fang Kong^[4] from the perspective of urbanization, in 1997-2014, 31 provinces panel data of population urbanization and citizenization phase separation characteristic system comparison, also concluded in the process of urbanization, China urbanization and urbanization of urban and rural income gap are significant inverted U-shaped effect, on the basis of citizenization level promotion is the key to narrow the urban and rural income gap. In addition, from the study of the urban and rural income gap narrowing countermeasures. Lai Wei^[5] through the 2002-2015 interprovincial panel data empirical research and analysis found that breaking the dual structure, driving urbanization by urbanization, and in turn, urbanization promotes urbanization development, so as to narrow the urban-rural income gap. In a research report by Liu Xu et al^[6], it was proposed to adjust the distribution pattern of national income, further improve the social security system and adjust the structure of fiscal expenditure to narrow the urban and rural income gap. Lewis^[13] pointed out in its "dual" economic model that in the process of urbanization, the income gap between urban and rural areas widens the income gap as labor flows from countryside to cities. Adelman^[15] proposed that the binary economy is, namely the rural economy and the urban economy. In the process of resource factor transfer, the factor return rate of each part is different, which leads to the increase of the income gap of the residents corresponding to the binary economy. Depending on the influencing factors. Kuznets^[14] believes that the different effects of industrialization on urban-rural income gap in different stages of industrialization. The World Bank research report^[16] believes that the contribution to developed urban areas and actively promote the coordinated development of rural economy will help narrow the gap between urban and rural development, and thus narrow the gap between urban and rural income. Chi-Wei^[12] et al. believe that the interaction pattern between urbanization and the urban-rural income gap varies from region to region.

Based on this, this paper uses the VAR model to process the two sets of data, first, a single set of data for unit root test, then stability test, and co-integration test, then Granger causality test, pulse response function analysis and prediction variance decomposition.^{[7][8][16]}In addition, when studying the exact relationship between urbanization and urban-rural income gap, measurement analysis is adopted to find that the change of urbanization rate has a significant impact on the urban-rural income gap, while the change of urban-rural income gap has no significant impact on the urbanization rate.

2. Model setting, variable selection, and data source

2.1 Data source

This paper selects the time-series data of the China Statistical Yearbook, previously collected for 22 years, from 1997 to 2018.

2.2 Variable selection

In order to reduce the effect of heteroscedasticity on the regression model, the selected data indicators were then logarithmically alized, and the urbanization rate and urban-rural income gap after the treatment were represented by LNUR and LNURIR, respectively. UR is the urbanization rate, and the basic meaning is to reflect with the population ratio. The urbanization rate = the urban

population / the total population. The larger the value is, the higher the urbanization level is. URIR represents the urban-rural income gap, and this paper selects the difference of the per capita disposable income of rural residents, which uses the formula: URIR= per capita disposable income of urban residents-per capita disposable income-per capita disposable income of rural residents.

2.3 Model setting

2.3.1 Model setting and stability test

This paper analyzes the relationship between urbanization and the urban-rural income gap in China. First, we need to test the stationarity and Granger data causality test, then build the vector autoregressive models, and finally perform the pulse response and variance decomposition analysis. The so-called VAR model was built based on a multivariate time series of data trends. Multiple variables can be predicted and results obtained. The VAR model can be used to analyze the effects of random perturbations on the endogenous variables of the system, and is a common tool for analyze the long-term dynamic relationships of economic systems.

The mathematical expression for the basic VAR (P) model is:

$$y_t = c + A_1y_{t-1} + A_2y_{t-2} + \dots + A_p y_{t-p} + BX_t + \varepsilon_t \quad t = 1, 2, 3, \dots, T \quad (1)$$

Where y_t is the column vector of k-dimensional endogenous variables, x_t is the column vector of d-dimensional exogenous variables; p is the lag order, and T is the number of samples. The $K * k$ -dimensional matrices A_1, A_2, \dots, A_p and $k * d$ -dimensional perturbed column vectors. The first condition of modeling the VAR is that each variable must remain stable of the same order. Therefore, the ADF test in the unit root test is conducted first, and the P-value obtained from the ADF test for the LNUR is 0.0038, that is, the LNUR is stable at the 5% significant level. The P-value derived from the ADF test for the LNURIR was 0.015, and the LNURIR was stable at the 5% significance level. Next, the stability of the VAR model between China's urbanization rate and urban-rural income gap is tested. The results are shown in the following figure:

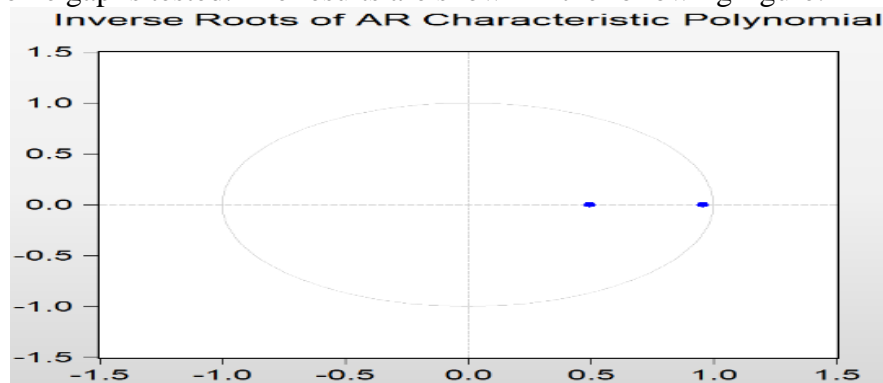


Figure 1: Discriminative diagram of the VAR system stability

Figure 1 shows that the inverse of the root of all the var characteristic polynomials is within the unit circle, and that the VAR system is stable. Therefore, we can build a VAR model for urbanization and urban-rural income gap. However, one of the most important problems in the VAR model is the determination of the appropriate lag order. In determining the lag order, on the one hand, assume that the lag order is large enough to fully reflect the dynamics of the constructed model; on the other hand, if the lag order will have more parameters to be estimated, and the degree of freedom of the model will be very low. Therefore, the method to determine the lag order in this model is to combine the trial and error method with the AIC and SIC information criteria, and the

best lag order is order 1. Then, an order 1 vector autoregressive model, VAR (1), was created.

2.3.2 The Granger causality test

In order to analyze the causal relationship between urbanization and urban-rural income gap in China, the VAR model established by variable UR and URIR was tested by Granger causality, and the test results are shown in the following Figure 2:

Dependent variable: LNUR			
Excluded	Chi-sq	df	Prob.
LNURIR	2.189831	1	0.1389
All	2.189831	1	0.1389

Dependent variable: LNURIR			
Excluded	Chi-sq	df	Prob.
LNUR	5.255428	1	0.0219
All	5.255428	1	0.0219

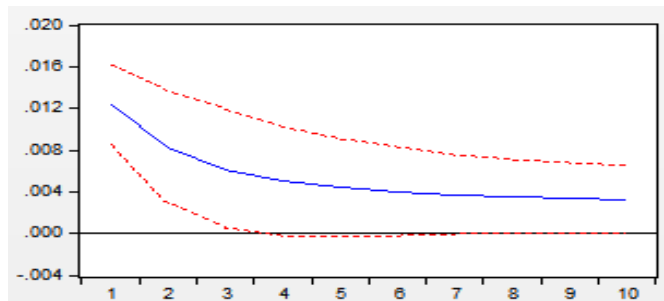
Figure 2: Granger causality test results of China's urbanization and income gap in cities

The Granger causality test shows that the relationship between the obtained variables is not really causal, they are just a dynamic correlation relationship, which can be used to analyze whether one variable can predict another variable. The upper part of the figure above shows that the assumption that the urban-rural income gap is not the level of urbanization development is acceptable, that is, the change of the urban-rural income gap will not lead to the change of urbanization, that is, the widening or narrowing of the urban-rural income gap will have little direct impact on the urbanization development. Perhaps the urbanization rate is only the development level of a country, which is related to the assessment of a country or even the assessment of local officials, and may be greatly affected by policies, and basically not affected by the income gap between urban and rural areas. The bottom half of the figure above shows that the assumption that the level of urbanization is not the urban-rural income gap was rejected. That is to say, the change of the level of urbanization development will cause the change of the urban-rural income gap, or the level of urbanization development will directly affect the size or great impact of the urban-rural income gap. That is to say, the development of urbanization will have a greater impact on the income increase of urban residents, and also the income of rural residents, but the income cannot increase than that of urban residents. The income level of urban and rural residents will grow larger and larger.

2.3.3 Pulse response function analysis and prediction variance decomposition

From the above can know, granger causality test is not really in the causal sense, just preliminary concluded the relationship between variables, but also cannot reflect a variable to oneself and other variables, at the same time VAR model contains a lot of more parameters, what these parameters mean meaning is difficult to explain. So the next step is needed to analyze the pulse response

function of the VAR model. The pulse response function was used to measure the effect of the standard deviation of a random interference on the current and future values of the endogenous variables. Figure 3, 4, 5 and 6 are the simulated pulse response curves and results of the model VAR (1), which are as follows:



Note: The horizontal axis is the number of lag periods of the impact action, the blue line is the pulse response function, reflecting the response of each variable to the corresponding impact, and the red line is listed as twice the standard deviation deviation band similarly hereinafter.

Figure 3: Pulse response of urbanization rate to urbanization rate

Figure 3 shows the degree of change in the urbanization development level when the urbanization rate per unit of standard deviation is impacted. As shown above, the blue line is always above the horizontal axis and is always positive. The change response of the level of urbanization itself is always positive, and the positive unit standard deviation can bring continuous positive reflection to urbanization. During this period, responses were most important and reached a positive effect of 0.0123. After this, there is a rapid decline process, especially in the first lag phase to the third lag phase, the most rapid decline. Judging by its slope, it is also the most rapid decline in this time period. The slope is the number of responses changing for each lag phase. After the lag of phase 10 to 0.0032, and after the fifth phase, it basically stabilized, with a relatively long sustained response.

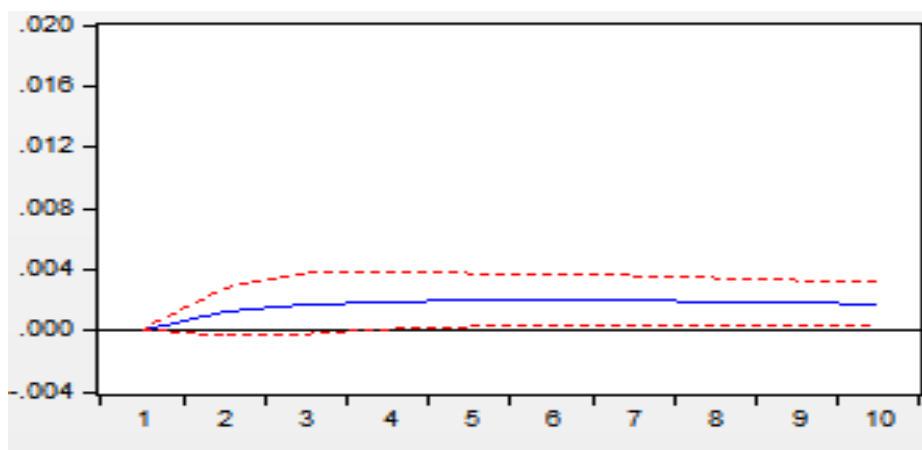


Figure 4: The pulse response of the urbanization rate to the urban-rural income gap

Figure 4 is to further explore the response of urbanization development to the urban-rural income gap. It can be seen that the impact of urbanization development to the impact of a standard deviation of urban-rural income gap is not high. The response in the first phase of lag is almost 0, only weak in the second phase of lag, the subsequent response is almost stable, even small fluctuations, the response in the fifth phase to the eighth phase of lag is the most intense, but the value is only 0.00199, less than 0.002. It is too trivial for Figure 5. Therefore, the results of the Granger causality test are also verified here, and the urban-rural income gap has a small or no direct

impact on urbanization. It reached 0.00,00174. Except for the lag period, urbanization has a sustained response to the one-unit standard deviation of urban-rural income gap. In this paper, the choice is the VAR model.

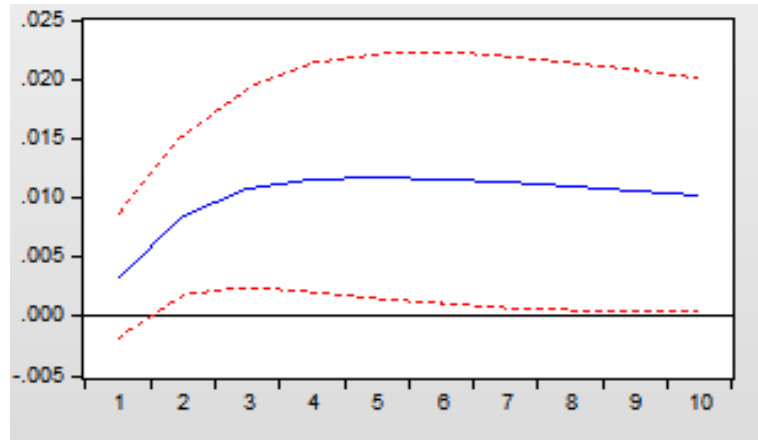


Figure 5: Pulse response of urban-rural income gap to urbanization rate

Figure 5 shows the urban and rural income gap by a unit of standard deviation of urbanization rate impact degree of change, when the urbanization rate is affected by the unified standard deviation, the blue line is always located above the horizontal axis and always positive, urban and rural income gap for a unit of standard deviation of urbanization impact change response is always positive, is continuous positive reflection. In the current period, there is a relatively large positive impact of 0.0034, and the response is even higher compared with the maximum value in Graph 2.4, which shows that urbanization has a more grounded impact on the urban-rural income gap. The blue line is a mountain type. Before the five-period lag period, with the increase of the lag order, the response degree of the urban and rural income gap to the urbanization with one unit of standard deviation is increasing, that is, the value is getting larger and larger. And in the second lag phase, it is a rapid rising process, with an obvious promoting effect and a longer sustained effect. In the fifth phase, the urban-rural income gap is the greatest response to the impact of urbanization with one unit of standard deviation. The following is a gradual reduction process, and even tends to stabilize, but the response is still very large. The lag of 10 periods reached 0.0101 and had a large sustained response. Overall, the widening urban-rural income gap has a significant positive response to urbanization; below, we discuss the response of the urban-rural income gap to its own changes.

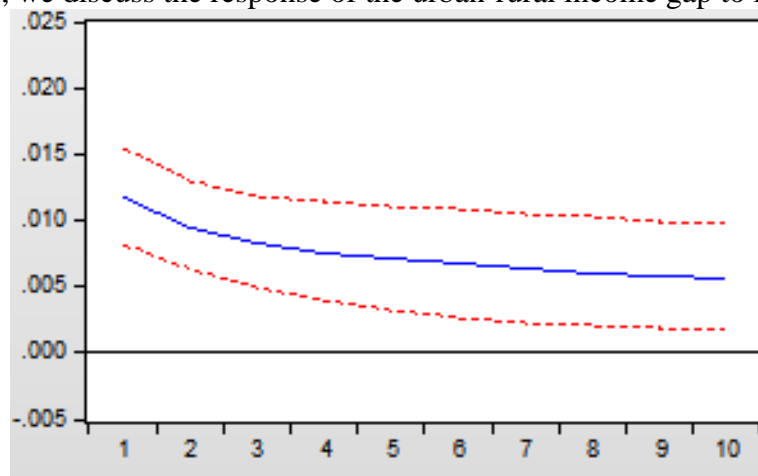


Figure 6: Pulse response of urban-rural income gap to urban-rural income gap

We can see from Figure 6 that it is basically consistent with the shape of Figure 5. It can be seen

that the blue line is always above the horizontal axis, always positive. It shows that the change response of the urban-rural income gap is always positive, and a positive impact of the unit standard deviation can bring a continuous and relatively stable positive reflection to the urban-rural income gap. It can be seen that the impact has the most significant impact on the urban-rural income gap in the current period, with a positive impact of 0.0117, followed by a slow decline process, with the second lag phase and the third phase of the lag period, and the decline was small until the tenth lag phase, reaching the lowest of 0.0056. There was a sustained and stable positive response, but overall, the urban-rural income gap was a significant positive response to itself.

To sum up, in the short term, the impact effect of urban-rural income gap has a large wave ratio and has a positive impact. In the long run, even if it will have an impact, the impact is much less than that in the short term. In the first stage, urbanization is only affected by its own fluctuations; in the second stage, urbanization is affected by the fluctuations of the urban-rural income gap, and shows a gradual widening trend. This shows that in the short term, urbanization is less affected by the impact of urban-rural income gap. In the long term, urbanization is affected by a certain urban-rural income gap, but the impact is not as big as urbanization on the urban-rural income gap. The development of urbanization can widen the income gap between urban and rural areas, and this relationship will not disappear in a relatively short time. However, the impact of urban-rural income gap on urbanization does not exist in the short term, and in the long term, there will only have a weak impact, which does not form a negative impact and tends to be stable.

2.3.4 Predicted variance decomposition

One application of the VAR model is the prediction. To measure the effect of one variable on another, the predicted variance decomposition was determined. Variance decomposition is the decomposition of the fluctuations of each endogenous variable in the model into the associated components of the equations according to the formation causes. By analyzing the contribution of each structural shock to the change of the endogenous variables, we can understand the relative importance of different structural shocks to the endogenous variables of the model. Here we use an asymptotic analysis to decompose the individual inline changes from the inline to the VAR (1) model. The results are obtained in Table 1.

The top half of Table 1 is divided into the decomposition results of urbanization: urbanization is divided from left to right, and the contribution rate of urban-rural income gap to urbanization. It can be seen that urbanization's contribution rate to itself is the largest, reaching the largest contribution rate in the first period of lagging behind: 100%. Then, a slow decline began, at roughly the same rate, with the lowest contribution rate at 92.55% when lagging behind the tenth period. If described by a straight line, it is almost a oblique line for a day. On the contrary, the contribution rate of urban-rural income gap to urbanization is shown. The contribution rate in the first period of the lag is only 0%, after which the contribution rate begins to rise slowly. Marginal contribution rate is a process of rising first, then falling, but all are positive. The maximum value was reached: 7.45%. The two are a complementary relationship. In general, the contribution rate of the urban-rural income gap to urbanization will remain around 10%, because the marginal contribution rate is a decreasing trend. Even so, the impact of the urban-rural income gap on urbanization is also insignificant compared with that of urbanization on itself.

The lower half of Table 1 shows the results of the decomposition of urban-rural income gap: from left to right, the contribution rate of urbanization and urban-rural income gap to urban-rural income gap is respectively. It can be seen that in the short term, the contribution rate of urban-rural income gap to itself reached the maximum value of 92.28%. It is a rapid decline process starting from the lag first phase, and the contribution rate is less than 50% in the lag fifth phase. It drops slowly until the tenth lag, reaching a minimum proportion of 35.56%. The difference is the

contribution rate of urbanization to urban-rural income gap. In the early stage, the contribution rate of urbanization to urban-rural income gap is 7.7%, but it is still higher than the contribution rate of urban-rural income gap to the highest contribution rate of urbanization. There was a rapid increase in the contribution rate in the second lag period. In the second lag phase, it reached 26.8%, and again, in the fifth lag phase, it exceeded 50% and dominated. Subsequently, there is also a diminishing marginal contribution rate. By the tenth lag period, it rose to a high of 64.44%. In general, in the long term, the biggest impact on the urban-rural income gap is the level of urbanization development. In the short term, the urban-rural income gap has the biggest impact on itself.

Table 1: Results of the variance decomposition table of urban and rural income gap and urbanization

Variance Decomposition of LNUR:			
Period	S.E.	LNUR	LNURIR
1	0.012315	100.0000	0.000000
2	0.014862	99.38313	0.616866
3	0.016167	98.37291	1.627094
4	0.017033	97.26356	2.736444
5	0.017696	96.20496	3.795038
6	0.018245	95.25448	4.745517
7	0.018719	94.42358	5.576421
8	0.019138	93.70461	6.295394
9	0.019512	93.08373	6.916273
10	0.019850	92.54645	7.453553

Variance Decomposition of LNURIR:			
Period	S.E.	LNUR	LNURIR
1	0.012156	7.724108	92.27589
2	0.017606	26.80419	73.19581
3	0.022219	40.10754	59.89246
4	0.026168	48.49962	51.50038
5	0.029540	53.90395	46.09605
6	0.032430	57.53733	42.46267
7	0.034925	60.08786	39.91214
8	0.037096	61.94819	38.05181
9	0.039000	63.35035	36.64965
10	0.040680	64.43690	35.56310

Cholesky Ordering: LNUR LNURIR

3. Conclusion

Through the above empirical analysis, we can conclude that in the short term, the increase of urbanization rate will widen the income gap between urban and rural areas, and in the long term, the income gap will lead to a widening and eventually peak. On the other hand, the impact of the urban-rural income gap on the urbanization rate, whether in the short term or in the long term, the impact of the urban-rural income gap on the urbanization rate is relatively smaller than the urbanization rate on the urban-rural income gap, that is to say, the urban-rural income gap is not the reason for the expansion or narrowing of the urbanization rate. The impact between the urbanization rate and the urban-rural income gap is one-way, that is, the urbanization rate affects the urban-rural income gap.

4. Countermeasures and suggestions

4.1 Based on the new development concepts and the new development ideas, we will promote the new urbanization construction

Since China is now in the initial stage of urbanization construction, urbanization will widen the income gap between urban and rural areas. The studied results are in line with the view of the inverted "U" hypothesis, partly because it emphasizes quantity and scale, and does not pay much attention to quality. In the context of the rural revitalization strategy, we will promote the development of urbanization based on new ideas and new ideas, which will accelerate beyond the stage of widening the urban-rural income gap.^{[7][8]}The specific practices are as follows:

Reform of the household registration system. In today's society, urban hukou has better social welfare, which makes the birth at the same time, born in different places with different treatment, congenital, it expands the income gap. Therefore, under the new urbanization, it is necessary to improve the household registration mechanism and eliminate the different benefits brought by the different urban and rural hukou.^[9] The reform of the household registration system is the first barrier to break the dual structure of urban and rural areas.^[10] Only through the reform of the household registration system, the relationship between social welfare and the attribute of the household registration can be continuously weakened, so that farmers are not bound by their identities and completely liberate the rural productivity.^[11]

In different regions, different social security policies such as medical care and pension education should be formulated and improved. Such policies must be subordinate to the spirit of targeted poverty alleviation. On the one hand, focus on the vulnerable groups, raise the minimum living security standard by expanding transfer payments and subsidy incentives, and encourage farmers to obtain higher income; on the other hand, tilt the rural medical and education resources, gradually narrow the gap between urban-rural social security, so as to eliminate the urban-rural dual structure and make this measure effective in the long term.

4.2 We will further strengthen rural economic development under the new type of urbanization

In the future process of urbanization construction, the focus will be transferred to the rural economic construction. Under the implementation of the policy of "three reduction and one reduction", excessive human resources, material resources and financial resources in cities can be appropriately tilted to rural areas, so that resources can be fully used, which is of great significance for the cost reduction of manufacturing enterprises, and is conducive to supplementing the short leg of agriculture, the primary industry. In turn, the development of rural economy should be accelerated to promote the healthy development of urbanization.^[12] Agriculture has a high potential. As the foundation of a country, the in-depth development of agriculture will be conducive to accelerating the process of rural urbanization.

4.3 Policies to guide and support foreign investment into rural areas

Vigorously introduce foreign investment to promote rural economic development. The introduction of foreign capital can directly drive the innovation of agricultural products and the development of agricultural products-related enterprises, and play a certain role in promoting the growth of farmers' income. At the same time, the entry of foreign capital will introduce the experience and technology indirectly brought by related funds, and completely liberate the countryside, so that they can face the new era and enjoy the benefits brought by high technology.

Specific method: foreign capital enters rural to run production, low interest or no interest loan, enter rural to run production, land free use right.

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