Scientific and Social Research, 2024, Volume 6, Issue 6
https://ojs.bbwpublisher.com/index.php/SSR

The Urban-rural Income Gap, Urbanization, the Upgrading of Industrial Structure, and Agricultural Labor Productivity

Fangyuan Lou*

School of Social Sciences, Harbin Institute of Technology, Harbin 150001, Heilongjiang Province, China

***Corresponding author:** Fangyuan Lou, 1226621258@qq.com

Abstract: Agricultural labor productivity reflects the relationship between labor factor input and economy in the agricultural industry, and improving agricultural labor productivity is an important way to achieve agricultural modernization and high-quality agricultural development. Based on the VAR model and Granger causality test, this paper conducts an empirical analysis of the impact of urban-rural income gap, urbanization, industrial structure upgrading, and agricultural labor productivity in China from 1981 to 2020, and concludes that there is a long-term cointegration relationship between urban and rural income gap, urbanization and industrial structure upgrading and agricultural labor productivity. In the long run, the urban-rural income gap and industrial structure upgrading have a positive impact on agricultural labor productivity. Urbanization has a negative impact on the improvement of agricultural labor productivity, so relevant suggestions are given.

Keywords: Urban-rural income gap; Urbanization; Industrial structure upgrade; Agricultural labor productivity

Online publication: July 9, 2024

1. Introduction

The agricultural labor productivity in China is low compared with the international market. At the same time, China faces a series of challenges such as the contrasting structure of urban and rural areas and the unbalanced development of urban and rural social structure. The improvement of the relative state of agricultural labor productivity is a prerequisite for agricultural modernization. In this regard, exploring the impact of the urban-rural income gap, urbanization and the upgrading of industrial structure on agricultural labor productivity is of great significance for exploring the path of rural revitalization and balanced urban-rural development.

2. Literature review

The essence of modern agriculture is the increase of productivity and labor productivity [1]. Hayami and Ruttan emphasize that the issue of agricultural development is not to transform a static agricultural sector into a

modern dynamic sector but to accelerate the growth rate of agricultural output and productivity in line with the growth of other sectors of the modernizing economy [2]. Xin and Qin pointed out that China's agricultural labor productivity growth at present mainly relies on factor accumulation factors, including capital and other factor input accumulation [3–4]. Existing studies have paid more attention to the impact of urban-rural income gap and urbanization on agricultural labor productivity, and paid less attention to the impact of industrial structure upgrading on agricultural labor productivity. Based on the above literature research, this paper further uses the VAR model and Granger causality test to analyze the data of China's 40 years from 1981 to 2020 in the context of agricultural modernization and discusses the impact of the urban-rural income gap, urbanization, and the upgrading of industrial structure on China's agricultural labor productivity.

3. Influence mechanism

Migrant workers can obtain relatively high income, attract rural labor to leave the countryside, transfer and centralize the management rights of rural land, promote the agglomeration and development of agricultural industry, help increase capital investment and the spread of technological progress, create conditions for the scale and mechanization of agricultural industry operation, reduce agricultural production costs, and improve labor productivity [5]. Urbanization has not transformed urban farmers into the urban registered population, farmers will not give up land, and the scale of arable land per labor has not significantly expanded, which inhibits the increase of the land-labor ratio. At the same time, the price difference between industrial and agricultural products makes rural capital flow into the city, and the large gap between rural infrastructure and basic public services such as education and health care also inhibits the return on capital in rural areas. The advanced development of industrial structures widens the income gap between urban and rural areas and then affects the transfer of labor force, urban and rural industrial structure, and urban distribution. The new industrial formats have higher utilization of labor production factors and higher resource allocation efficiency, and the spillover effect of technological innovation promotes the improvement of agricultural labor productivity. Based on the above analysis, this paper puts forward the hypothesis that the urban-rural income gap, the upgrading of industrial structure, and urbanization have positive and negative effects on agricultural labor productivity.

4. Data selection and variable description

This paper selects 40 years of data from 1981 to 2020, all of which are from the National Bureau of Statistics, as shown in **Table 1**.

Agricultural labor productivity (LDS): The total output value of agriculture, forestry, animal husbandry, and fishery is divided by the employment of the primary industry, and 1981 is the base period after the logarithm. The urban-rural income gap (DT): The Thiel Index can directly measure the income gap between urban and rural areas, and is sensitive to the changes of the two classes. The Theil index is used for measurement as follows:

$$DT = \frac{I_{ut}}{I_t}\ln\left(\frac{I_{ut}}{I_t}/\frac{P_{ut}}{P_t}\right) + \frac{I_{rt}}{I_t}\ln\left(\frac{I_{rt}}{I_t}/\frac{P_{rt}}{P_t}\right) \quad (1)$$

Among them, I_{ut} and I_{rt} are the total urban and rural income in t years, which is obtained by multiplying the per capita income of urban and rural residents with the number of urban and rural population; P_{ut} and P_{rt} respectively represent the number of the urban and rural population in t years; I_t represents the total urban and rural income in t years; P_t represents the total urban and rural population in t years. The smaller the DT, the smaller the urban-rural income gap.

Urbanization (UR): the proportion of urban population in the sum of rural population and urban population. Industrial structure upgrading (HIG): the ratio of the added value of the tertiary industry to the added value of the secondary industry.

Table 1. Descriptive statistics

Variable	Maximum	Minimum	Mean	Standard deviation	Median
LDS	9.175	6.583	7.781	0.789	7.722
DT	0.154	0.037	0.104	0.033	0.104
UR	0.639	0.202	0.39	0.137	0.369
HIG	1.439	0.494	0.893	0.239	0.876

5. Empirical analysis

5.1. Unit root test

To avoid false regression caused by OLS direct regression of unstable sequences, ADF tests the stationarity of the selected variables in this paper, and the results are shown in **Table 2.** The original time series of each variable is not stationary. The second-order difference treatment of the above variables shows that the new time series are all stationary time series at a 1% confidence level. LDS, D, UR, and HIG are all second-order single integrations, which can be tested for co-integration.

Table 2. ADF test list

Variable	Difference order	*t*	*P*	1%	Critical value 5%	10%	Smooth or not
LDS	0	-0.005	0.958	-3.639	-2.951	-2.614	No
	2	-5.079	0.000***	-3.639	-2.951	-2.614	Yes***
HIG	0	-1.703	0.430	-3.616	-2.941	-2.609	No
	2	-7.641	0.000***	-3.621	-2.944	-2.61	Yes***
DT	0	-1.504	0.531	-3.639	-2.951	-2.614	No
	2	-5.607	0.000***	-3.639	-2.951	-2.614	Yes***
UR	0	-2.158	0.222	-3.621	-2.944	-2.61	No
	2	-9.068	0.000***	-3.621	-2.944	-2.61	Yes***

Note: * P < 0.1; ** P < 0.05; *** P < 0.01

5.2. Co-integration test

The cointegration test results show that the order of selection of most information criteria is 2, and VAR lags 2 orders for modeling. Johansen cointegration test shows that the eigenvalue of each characteristic equation is located in the unit circle, and the test results are shown in **Table 3.**

The results of the pure randomness test are shown in **Figure 1**. The sequence has no too-large or too-small value, no periodicity, and no obvious increasing or decreasing trend. $cov(x_t, x_{t+k}) = 0$, ($x = LDS, DT, UR, HIG$) is true, and the graph fluctuates around a fixed value, which is a purely random sequence.

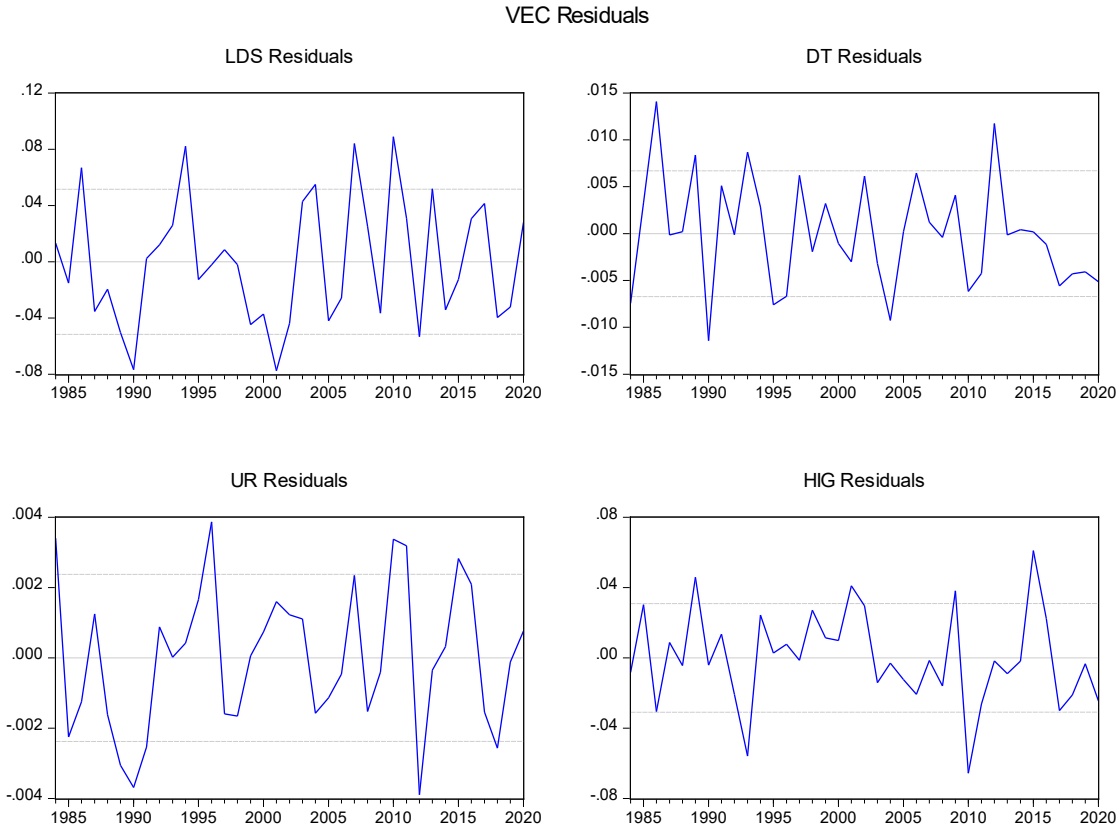

Figure 1. Time sequence diagram test

Table 3. Results of the VAR cointegration test

Hypothesize DT No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.717413	71.10977	47.85613	0.0001
At most 1	0.279078	24.35034	29.79707	0.1860
At most 2	0.211834	12.24303	15.49471	0.1456
At most 3	0.088666	3.435302	3.841466	0.0638

Note: * For tests that reject the null hypothesis, the confidence level is 0.05

As can be seen from **Table 3**, when the null hypothesis cointegration equations are 0, that is, the statistic is 71.10977 > 47.85613, the null hypothesis is rejected, indicating that LDS, DT, UR, and HIG exist cointegration relationship. When the number of cointegration equations is assumed to be at most one, the trace statistic is 24.35034 < 29.79707. Accepting the null hypothesis, it indicates that only one cointegration equation exists among LDS, DT, UR, and HIG, that is, there is a long-term equilibrium cointegration relationship. Granger causality test can be performed. The cointegration relation expression is represented by *E*.

$$E = lds - 178.663D + 142.943ur - 58.92126hig + 8.07026 \quad (2)$$

According to the cointegration equation, it can be seen that DT and HIG have positive effects on LDS. UR has a negative effect on LDS. In Formula 2, DT has the greatest influence on LDS. At the same time, the co-integration vectors are both significantly non-zero and negative, indicating that between 1981 and 2020, the urban-rural income gap and the upgrading of industrial structure are positively correlated with agricultural labor productivity, while urbanization is negatively correlated with agricultural labor productivity, and both are long-term stable. Without considering other factors, when DT, HIG, and UR increased by 1 percentage point, LDS

increased by 178.663, increased by 58.92126, and decreased by 142.943 percentage points respectively.

5.3. Granger causality test

The Granger causality test can provide evidence for the causal direction in economic relations, that is, the consistent and predictable change of a time series variable before the change of another variable. According to the results of the Granger causality test in **Table 4**, at the significance level of 5%, agricultural labor productivity (LDS) can cause changes in the urban-rural income gap (DT); at the significance level of 10%, urban-rural income gap (DT) can cause changes in agricultural labor productivity (LDS), and there is a dual Granger causality relationship. Urban-rural income gap (DT) is the Granger cause of agricultural labor productivity (LDS).

At the significance level of 5%, agricultural labor productivity (LDS) can cause the change of industrial structure upgrading (HIG), and industrial structure upgrading (HIG) can cause the change of agricultural labor productivity (LDS), and there is a dual Granger causality relationship. The upgrading of industrial structure (HIG) is the Granger cause of agricultural labor productivity (LDS).

Table 4. Granger causality test between LDS and DT, HIG, and UR

Paired	Sample	*F*	*P*
DT	LDS	3.419	0.045**
LDS	DT	2.975	0.065*
HIG	LDS	3.456	0.043**
LDS	HIG	5.252	0.010**
UR	LDS	5.294	0.010**
LDS	UR	0.728	0.490

Note: * $P < 0.1$, ** $P < 0.05$, *** $P < 0.01$

6. Conclusions and suggestions

Based on the VAR model and Granger causality test, this paper empirically analyzes the impacts of urban-rural income gap, urbanization, industrial structure upgrading, and agricultural labor productivity in China from 1981 to 2020, and concludes that there is a long-term co-integration relationship between urban-rural income gap, urbanization, industrial structure upgrading, and agricultural labor productivity. In the long run, the income gap between urban and rural areas and the upgrading of industrial structures have a positive impact on agricultural labor productivity, and urbanization has a negative impact on agricultural labor productivity. Relatively speaking, the income gap between urban and rural areas has the greatest impact on agricultural labor productivity, and the upgrading of industrial structure has the least impact on agricultural labor productivity.

To effectively improve agricultural labor productivity, this paper puts forward some suggestions, such as reducing the corresponding agricultural production cost, improving the environment and conditions for agricultural production and operation, and actively promoting urban-rural integrated development and balanced development. The government should promote equal access to basic public services in urban and rural areas, deepen the reform of household registration and land system, and accelerate the efficiency and mobility of rural land redistribution. Efforts should be made to promote the transformation of agricultural business entities, organizational methods, and industrial forms. Based on diversified business entities, the integrated development of industries is realized through agriculture with industry, agriculture with the service industry, and so on, and

the other functions of agriculture such as ecology and culture are fully tapped.

Disclosure statement

The author declares no conflict of interest.

References

[1] Schultz TW, 1985, Transforming Traditional Agriculture. Yale University Press, New Haven.

[2] Hayami Y, Ruttan VW, 1985, Agricultural Development: An International Perspective. The Johns Hopkins University Press, Maryland.

[3] Xin XF, Qin F, 2011, Decomposition of Agricultural Labor Productivity Growth and its Regional Disparity in China. China Agricultural Economic Review, 3(1): 92–100.

[4] Polyzos S, Arambatzis G, 2006, Labor Productivity of Agricultural Sector in Greece: Determinant Factors and Interregional Differences Analysis. New Medit, 5(1): 58–64.

[5] Kawasaki K, 2010, The Costs and Benefits of Land Fragmentation of Rice Farms in Japan. Australian Journal of Agricultural and Resource Economics, 54(4): 509–526.